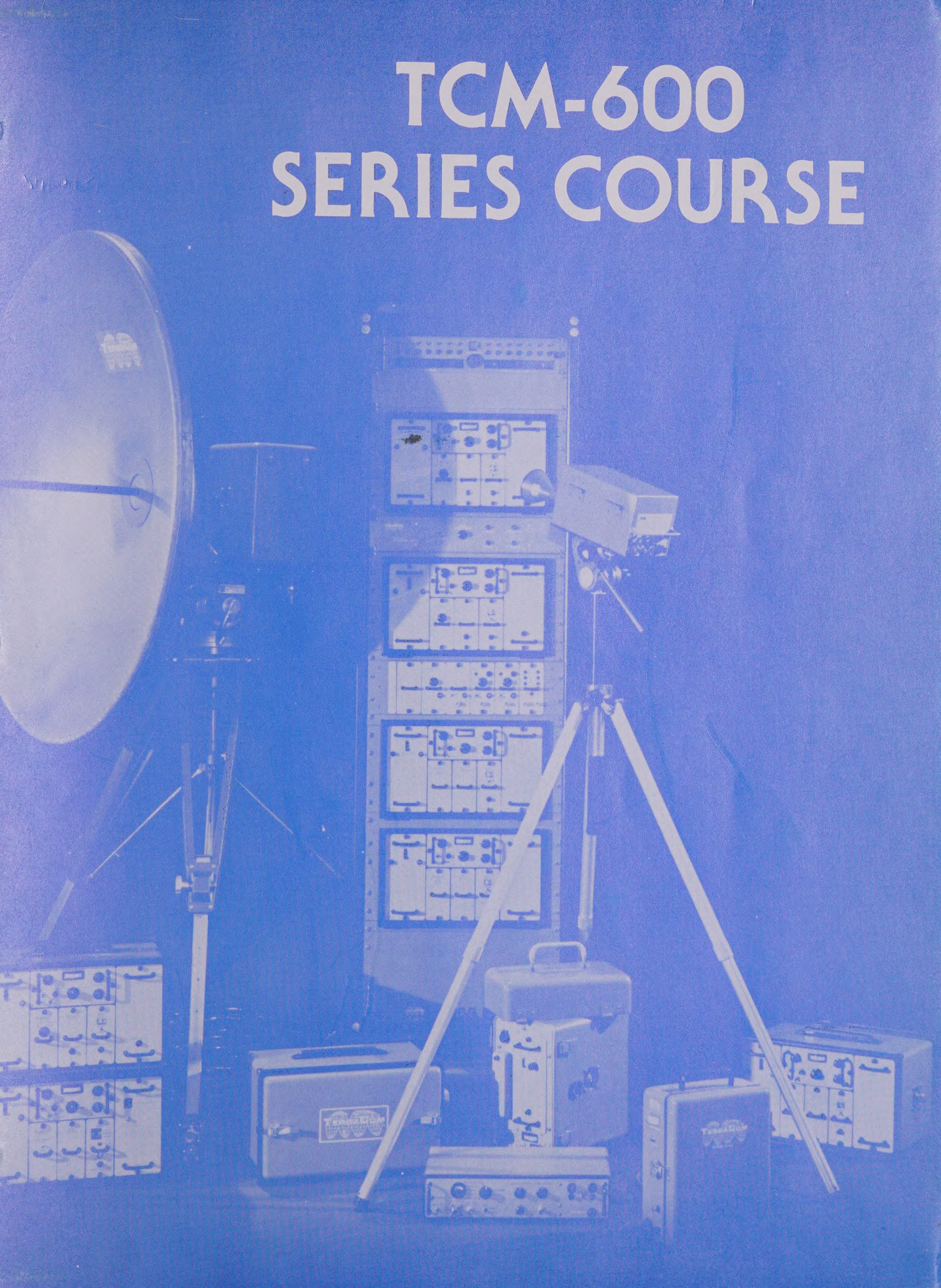
TCM-600 Series

Loral Microwave Communications

TERRACOM®

ABC

TCM-600 SERIES COURSE



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TCM-600 DESCRIPTION

The TCM-600 Series radios are portable, modular microwave radios that are easy to reconfigure for different applications. The radios are available in video, message and digital formats. Audio program channel, wideband, and digital subcarriers are available. To change the operating frequency band of the radio, it is only necessary to change the RF module. If properly set up, the radio is weatherproof and can be mounted on a tripod with up to a 6 ft. dish, on a tower, or rack mounted. The RF module may be mounted in a remote enclosure that can be mounted at the dish to avoid long waveguide runs. AC or DC input power supplies are available, with the DC version operating at either 28 or 48 VDC and the AC version operating at either 115 or 230 VAC, 50-400 Hz. A diversity baseband switch and hot standby switch are available to provide fully redundant duplex operation. Each function performed in the radio is performed on a discrete card, providng very flexible configuration possibilities.

The radios are comprised of the following modules:

XMTR		RCVR	
L	Power Supply	L	Power Supply
TOP	Control Monitor	TOP	Control Monitor
A	Baseband	A	Baseband
C	Auto. Freq. Control	C	Auto. Freq. Control
B	Synthesizer	B	Intermediate Freq.
R	RF	R	RF

The TCM-600 Series radios are constructed in a simple yet flexible manner. Each radio has 6 plug-in modules, as just described. All of the modules except for the RF module, can be removed by simply loosening two thumbscrews and pulling them out. The RF module also has a RF connector on the right side panel. An adaptor screws in through the right side of the radio, into the RF module. This adaptor must be removed before loosening the RF module thumbscrews. To remove it, first remove the four screws in the adaptor flange and then simply unscrew the adaptor. The cases are seamless and the front and rear bezels seal tightly to it, with rubber gaskets providing weather-tight seals. All of the electrical interconnections with the radio, except for the RF, are made via the connectors on the back panel. The wiring harness is located under the back cover. When replacing the back cover it is advisable to seal the rubber gasket that fits against the connector panel with RTV, to maintain, weathertight integrity. Also, seal the screw holes on the back panel, and the RF adaptor whenever they are replaced. Inside the case, beryllium copper wipers transfer heat from the RF module and the power supply to the case. A fan on the power supply exhausts hot air from the inside of the power supply.

TX CONTROL MONITOR

See TX Block Diagram Module A6.

The primary signal input to the control monitor is the baseband signal. It first hits an optional message amplifier, if it is installed. There are two message amplifiers available. The standard message amp may be strapped for 0, 5, or 15 dB of gain. The CCIR message amp may be strapped for 0, 15 (1900 Ch.), 24.5 (960 ch.) or 27 (300 Ch.) dB of gain. The input impedance of these amplifiers is normally 75 ohms unbalanced, although the CCIR amplifier can be strapped for a high impedance input. The output connects to the 75 ohm step attenuator and the BB signal goes from there to the

baseband module. The two audio inputs go to 0-10 dB step attenuators with 1 dB steps. The audio inputs are 600 ohm balanced. The audio signals go from the attenuators to the baseband modules. The alarm lamp on the front panel is connected to the fault buss so that if there is an alarm in any other module, it will show up on that lamp. If the optional remote fail relay is installed, it will provide a pair of dry contacts to actuate an external alarm. A U-link is provided in the control monitor to select connection of the service channel input to either the baseband or either one of the audio channels.

An optional test tone ocsillator is located in the control monitor. It generates a 2600 Hz tone which is sent to the baseband module. It can be turned on and off by a front panel switch. Another switch on the front panel operates an optional RF standby relay. A front panel meter reads 11 different transmitter functions. There are: +15 V, -15 V, -28 V,transmitter power, synthesizer, carrier deviation, AFC error, CH1 carr, CH1 dev., Ch2 carr, Ch2 dev. The last four functions are subcarrier indications.

BASEBAND MODULE

See TX Block Diagram Module A1

The baseband module can be configured for one of three possible applications; they are video, message and digital. Video and message are similar and will be treated first. Digital baseband modules will be treated subsequently. The baseband signal coming into the module goes through a low pass filter, strap attenuator, pre-emphasis, summing network, optional variable amplitude equalizer, and invert/non-invert amplifier. The low pass filter is chosen to match the bandwidth of the baseband. Both Butterworth and elliptical fitlers are available. The strap attenuator is installed to set the proper level at the input of the invert/non-invert amplifier. The pre-emphasis curve is chosen according to the application, message or video, and by the number of channels or resolution. The summing network sums the baseband, subcarriers and service channel inputs at the proper relative levels. The variable amplitude equalizer is used when the RF module is mounted in a remote enclosure. It is set for the number of feet of cable connecting the main enclosure and the remote enclosure. The invert/non-invert amplifier brings the baseband signal back up to .5V p-p and can be set to either invert or not invert the signal.

There is room in the baseband module for one or two subcarrier modulators, depending upon the module configuration. Narrowband audio subcarriers are available and may be configured to either EIA or CCIR specifications. They normally have a frequency response of 100 KHz but a 15 KHz low pass filter may be strapped in. Two types of wideband subcarriers are available. The biternary subcarrier is for transmitting partial response data at rates up to 2.048 Mb/s. A wideband subcarrier is available that has a 1.5 MHz frequency response. The digital baseband modules are available in various formats. The incoming data is conditioned and then put through a partial resonse filter. This output is the final baseband output. The output of the baseband module is routed to the RF module where it frequency modulates the RF carrier.

SYNTHESIZER

See TX Block Diagram Module A4

The purpose of the synthesizer module is to generate a crystal controlled reference frequency.

Four types of of synthesizer modules are available. The first two are simple crystal oscillators, the second two provide a synthesized output. The basic crystal version has a

crystal oscillator requiring a new crystal for each frequency change. An output detector causes a front panel alarm lamp to illuminate if the output fails. A second version provides a front panel switch to select between two separate crystal oscillators.

The basic digital synthesizer allows the frequency to be thumbwheel selectable. A VCO is controlled by comparing its freuqency to a high stability crystal reference frequency. The VCO sample is counted down through a programmable divider. The divider is controlled by the thumbwheels such that the resultant VCO frequency will be the same as the frequency indicated on the thumbwheels. The fourth type works the same as the basic digital synthesizer, but has two front panel thumbwheel switches with which it is possible to select up to 100 preprogrammed channels. The thumbwheels address a PROM, which addresses the programmable divider. The digital synthesizers require that the optional 5 volt card be installed in the power supply. The output of the synthesizer module goes to the RF module.

RF MODULE

See TX Block Diagram Module A2

The RF module is the "heart" of the radio. It modulates the RF output with the baseband input provided. The baseband input first is routed through the deviation control board. The purpose of the deviation control board is to set the modulation sensitivity af the RF head. In 601's, 602's, and some 603's a VCO driver amplifier is necessary to amplify the baseband signal to a level that is sufficient to properly deviate the VCO. The baseband signal then goes to the interface lamp driver board, where it is added to the AFC error voltage. It is then routed to the VCO. The interface lamp driver board also gets a DC sample of the RF output power and gives a fault light if the power drops by 6 dB. The output of the VCO is attenuated as necessary to drive the buffer amplifier at 250 - 300 mw. The buffer amplifier provides 1.1-1.5 watts of drive to the power amplifier. The power amplifier provides 5 watts of output power through an isolator and a bandpass filter to the module output in a 2 GHz (601) head. For higher frequency models, the output is routed through the appropriate multipliers and filters to provide the proper output frequency. The multipliers are passive devices, so that the higher the output frequency, the lower the output power is (see the specifications page in Section 4). Output power varies from 5 watts on a 601 to .150 watts on a 608.

A sample of the VCO at a level of +7 - +11 dBm is applied to the local oscillator port of a mixer. The synthesizer input is amplified and multipled in the X20 local oscillator amplifier and multiplier. The seventeenth through twenty-third harmonics are passed through a bandpass filter and go to the RF port of the mixer. The synthesizer frequency is chosen so that one harmonic will fall at 70 MHz below the VCO frequency.

The resultant 70 MHz output from the mixer is filtered and amplified in the 70 MHz filter amp and is sent to the AFC module at the level of -13 dBm.

AFC MODULE

See TX Block Diagram Module A3

The AFC module receives the 70 MHz from the RF module and counts it down to 13.35 Hz. A very stable 3.5 MHz oscillator is also counted down to 13.35 Hz and they are phase compared to either raise or lower the nominal -6 VDC output from the AFC module. This error voltage is routed back to the RF module, to the interface lamp driver board, where it is summed with the baseband signal. It will then correct the VCO frequency. If

the AFC loses lock for some reason, it lights a fault lamp on the front of the module and returns the output voltage to -6 VDC. The same thing happens if the module is disabled via the front panel switch. An optional off-the-air monitor is also available, it consists of a demodulator board, a baseband pre-amplifier, a de-emphasis circuit and a baseband amplifier.

The 70 MHz is demodulated and the baseband output is amplified to 1 V p-p and is available on the back panel.

POWER SUPPLY

See TX Block Diagram Module A5

The power supplies are the same in the receiver and the transmitter. Both types of supplies have plug-in regulator cards for each regulated output. The outputs available are a -28 volt unregulated and -28, -15, +15 and optional +5 volt regulated outputs. The -28 volt unregulated output is fused on the motherboard. The regulated outputs are overvoltage and overcurrent protected. The regulator cards are all linear regulators. The AC input supplies have an input transformer that supplies the necessary voltage to each card. The DC input supply has a switcher on the input and a transformer to supply the necessary voltages. No printed circuit boards or sub-assemblies are interchangeable between the DC and AC versions. The DC supply has reverse voltage protection.

RECEIVER RF MODULE

See RX Block Diagram Module A2

The receiver RF input passes through a preselector which may be either tunable or fixed tuned, depending on which type of RF module it is. The input signal then passes through a ferrite isolator to a mixer. The other input to the mixer is the local oscillator which is normally tuned 70 MHz below the receive frequency. The local oscillator may be either one of two types depending upon the frequency band of the RF module. The first method uses a VCO and appropriate multipliers (if any) to achieve the desired frequency. The second, packages the VCO and multipliers in one housing and is purchased "off the shelf" from other manufacturers. The local oscillator output level is adjusted by means of a fixed attenuator to provide +7 to +11 dBm at the mixer. The 70 MHz output from the mixer is amplified by a low noise amplifier and then passes through a phase equalizer. The phase equalizer compensates for group delay in the preselector. The 70 MHz signal goes from the phase equalizer to an active bandpass filter which sets the IF bandwidth. From here is is routed to the IF module.

IF MODULE

See RX Block Diagram Module A4

The 70 MHz input first passes through a phase equalizer. The phase equalizer compensates for group delay in the IF bandpass filter located in the RF module. From here, the 70 MHz is input to the main IF amplifier. The IF amplifier is a limiting amplifier.

The output level of the main IF amplifier varies less than $\pm$.5 dB for an RF input range from -78 dBm to -30 dBm. The output from this amplifier goes through the demodulator board. The demodulator provides two main outputs. One main output is the baseband signal, which goes to the invert/non-invert amplifier. The second is a DC error voltage which goes to the AFC module. The invert/non-invert amplifier has two outputs. The

main output goes to the baseband path of the baseband module. The auxiliary output goes to any subcarrier demodulators that may be in the baseband module.

BASEBAND MODULE

See RX Block Diagram Module A1

The baseband module processes the main input. This may include filtering, de-emphasis, and clamping. The baseband is then amplified and routed to the control monitor. An auxiliary output is routed straight to the back panel. Any subcarrier demodulator in the baseband module receives its input through a bandpass filter, demodulates it and routes the output to the control monitor.

If the baseband module is a digital version, it receives the partial response data from the IF module, conditions it, and recovers the timing. The data is derandomized and then the data and the timing are put into the chosen format, and then they are routed to the back panel.

CONTROL MONITOR MODULE

See RX Block Diagram Module A6

The control monitor receives the baseband and outputs from up to two subcarriers and passes them through variable attenuators. These attenuators are front panel adjustable from 0 to 10 dB in 1 dB steps. The outputs are then sent to the back panel. The control monitor houses an optional amplifier and speaker with which it is possible to hear the baseband or either subcarrier. A front panel meter monitors 11 different functions. These are: +15, -15, -28, signal strength, threshold, demodulator, IF out, carrier deviation, AFC error, Ch1 deviation, Ch 2 deviation.

AFC MODULE

See RX Block Diagram Module A3

The AFC module receives the frequency error voltage from the demodulator board and processes it. It then provides a correction voltage back to the local oscillator in the RF module. It is a tracking AFC and so will track a drifting transmitter. The module also receives a 70 MHz sample from the IF module and derives a signal strength indication from it. It also mutes the AFC module if the incoming signal drops below -85 dBm. When it mutes the module, it puts out -7 VDC to the local oscillator and lights the alarm lamp. It will also mute if the 70 MHz gets too far off of frequency. The AFC module has a capture range of 20 MHz.

TCM-600 FIELD ALIGNMENT PROCEDURE

This alignment is intended to ensure that the radio meets basic operating specifications. It uses basic test equipment that should be available in most microwave equipment maintenance shops. Steps that are preceded by an arrow (►) are recommended before each shot in portable applications, or semi-annually for fixed installations. The complete procedure is recommended at any time that there is an equipment failure or that the control monitor readings indicate substandard performance.

The RF input level to the receiver should be -30 dBm (or below). To establish an operating radio on the bench for alignment or test, connect the transmitter output to the receiver RF input, through enough attenuation to establish a -30 dBm level at the receiver's input.

The TerraCom TCM-600 Series radios are very flexible and may be configured to meet many dissimilar requirements. As a result, it is important to know what each specific radio is configured for (see "Options" pages). The IF bandpass filter in the RF module is occasionally reduced in bandwidth to meet a special customer requirement, so the user should be aware of any special configurations that are incorporated into any particular radio. After the user has established that the radio is configured for the desired application, the systems U-links should be placed in their proper positions (U-links are shorting straps that are used to configure the system, make interconnections, and set system parameters). Their correct positions are listed at the beginning of the alignment procedure.

I. CONFIGURATION FOR ALIGNMENT

A. TRANSMITTER

1. Power Supply

a. AC power supply - remove the right side cover. Select either 115 VAC input or 230 VAC input with the switch on the motherboard. See fig. 3-1.

b. DC power supply - remove the right side cover. Select either 28 VDC input or 48 VDC input with the voltage select card on the motherboard. See fig. 3-2.

2. Baseband Module

a. Remove both side covers.

b. Strap the pre-emphasis "out". See fig. 3-3.

c. Put the summing network U-link in the "Store" position. See fig. 3-4.

d. Put the invert/non-invert amplifier in the non-invert position. See fig. 3-5.

► 3. Synthesizer Module

a. The frequency set switches are on the right side of the module.
b. Set the proper synthesizer frequency for the desired output frequency. If the transmitter is equipped with a crystal oscillator type synthesizer module, then proceed to the next step. See fig. 3-6. If the transmitter is equipped with a digital synthesizer, (see fig. 3-7) set the frequency by the following formula:

$$Fx = \frac{(Fo/M) - 70\ MHz}{N}$$

Fx = crystal or synthesizer frequency, it must be between 95 and 100.5 MHz.

Fo - output frequency.

M = the last digit of the model number.

N = the Nth harmonic, it must be between 17 - 25.

4. AFC Module

a. Remove both side covers.

b. Baseband Pre-amplifier - put the U-link in the position of the last digit of the model number. See fig. 3-8.

c. Baseband Amplifier - put the U-link in E17 - E18. See fig. 3-10.

d. Strap the de-emphasis "out". See fig. 3-11.

e. If the radio has an analog AFC module (see fig. 3-12), put the U-link in the "A" position.

f. If the radio has a digital AFC, ensure that the two U-links are installed horizontally, see fig. 3-13.

5. Control Monitor

a. Set the baseband attenuator on the front panel to 5 dB. See fig 3-14.

b. If there is a message amplifier installed, set it for unity gain by strapping it for bypass, see fig. 3-15.

B. RECEIVER

1. Power Supply

a. Remove the right side cover.

b. If the radio has an AC power supply, select either 115 VAC input or 230 VAC input with the switch on the motherboard. See fig. 3-1.

c. If the radio has a DC power supply, select either 28 VDC input or 48 VDC input with the voltage select card on the motherboard. See fig. 3-2.

2. Baseband Module

a. Remove the right side cover.

b. Strap the de-emphasis "out". See fig. 3-11.

c. On the baseband amplifier, make sure that there is a U-link installed between E14 and E15. See fig. 3-10.

3. IF Module

a. Remove both side covers.

b. Place the invert/non-invert amplifier in the invert position. See fig. 3-5.

4. AFC Module

a. Remove the right side cover.

b. On the AFC board put the big U-link in the "A" position (tune the receiver local oscillator to 70 MHz below the carrier frequency). See fig. 3-12.

c. On the signal strength board place the U-link in the ~~"High~~ Mute" position. See fig. 3-16.

5. Control Monitor

a. Set the baseband attenuator on the front panel to the "0 dB" position. See fig. 3-17.

Always ensure that the transmitter RF output is properly terminated before energizing the transmitter. If it has not been done previously, choose an operating frequency and set the synthesizer for the correct frequency, using the procedure in step 1A3b.

II. ALIGNMENTS

A. TRANSMITTER ALIGNMENTS

1. AFC Module

a. Extend the AFC module. Disable the AFC by putting the front panel switch in the "down" (disabled) position. If the module

has a digital AFC board, perform Step b. If the module has an analog AFC board, perform Step c.

b. For digital AFC modules, measure the voltage from pin E10 to ground and adjust R24 for -6.00 VDC ±.05V. See fig. 3-13.

c. For analog AFC modules, remove the blue U-link(s). Measure the voltage from point "A" to ground and then from point "B" to ground for -6.00 VDC ± .05V. Adjust this voltage with R34. Next, measure from point A to point B and adjust R25 to get 0.00 V ± .05V. It may be necessary to alternate between these two adjustments several times to meet both specifications. Reinsert the blue U-link(s). Connect a frequency counter with an appropriate amount of attenuation to the RF output. Disable the AFC and adjust the transmitter tuning knob to get approximately the correct frequency. Enable the AFC module and adjust R6 to get the correct output frequency ± 15 KHz. If a microwave frequency counter is not available, it is possible to sample the 70 MHz signal and adjust R6 for 70 MHz ± 15 KHz. See fig. 3-12.

d. Insert the AFC module.

► 2. Baseband Module

a. Extend the baseband module.

b. Connect a test oscillator to the baseband input on the rear of the transmitter. Use the appropriate test signal as listed below:

SYSTEM	FREQUENCY	LEVEL
525 line systems	720 KHz	1 VP-P or +2.2 dBm
625 lines or greater	1.66 MHz	1 VP-P or +2.2 dBm

c. Connect an ACVM to the output of the last stage prior to the input of the invert/non-invert amplifier. This will be either the output of the summing network or the output of the variable amplitude equalizer if the radio is equipped to operate with a remote RF module. Using the strap attenuator, adjust it to bring this level to -17 dBm ±.5 dB. See fig. 3-4, 3-9, 3-18.

d. Move the meter to the output of the invert/non-invert amplifier and adjust R3 for an output of -3.8 dBm (.5 VP-P). See fig. 3-5.

e. Insert the baseband module.

3. RF Module

► a. Extend the RF module and remove the left side panel.

► b. Modulate the transmitter with the proper test signal (as chosen above). Tune the transmitter to the chosen frequency and enable the AFC. Look at the RF output on a spectrum analyzer. Adjust the deviation for 8 MHz P-P with R5 on the deviation control board. To accomplish this, turn the deviation down to 0. Then increrase the deviation slowly, watching for carrier nulls. Set for the first carrier null if a 1.66 MHz test tone is being used and for the second carrier null if a 720 KHz test tone is being used. See fig. 3-19.

c. Using a spectrum analyzer, look for any spurs or break up of carrier. All spurs must be 50 dB down from the unmodulated carrier.

d. Monitor the power output across the band. The minimum power output is 80% of the nominal specified power.

e. Tune the transmitter to the lower end of the band with the AFC disabled. Connect a frequency counter to the RF output and check the tapes frequency accuracy at regular intervals across the band.

f. Tune the transmitter to a point in the band that gives a 90 ua indication on the transmitter power position of the control monitor (alternately, adjust R20 in the control monitor to achieve a 90 ua reading). Clip a 500 ohm potentiometer across the resistor on the output bandpass filter (see fig. 3-19). Adjust the potentiometer until the transmitter power reading drops to half its original value. This simulates a 6 dB drop in power. The carrier fault light should come on just as the meter hits 45 ua. If it doesn't, adjust R6 on the interface lamp driver board so that the lamp just lights. See fig. 3-20.

g. Insert the RF module.

► 4. AFC Module (Off Air Adjustment)

a. Extend the AFC module.

b. Connect an ACVM to the off-the-air monitor output. With the proper test signal applied to the baseband input, adjust R1 on the baseband amplifier to get + 2.2 dBm or 1 VP-P out. See fig. 3-10.

c. Insert the AFC module.

5. Control Monitor

a. Extend the control monitor module. See fig. 3-14.

b. Adjust the various meter readings according to the chart below:

POT NUMBER	METER FUNCTION	VALUE
R1	+ 15V	50 ua
R20	XMTR PWR	90 ua
R17	SYNTH	50 ua
R16	CARR DEV[1]	50 ua
R13	AFC ERR[2]	50 ua

c. Insert the control monitor module.

B. RECEIVER ALIGNMENTS

The following steps that are preceded by an asterisk need an RF input level to the receiver that is measured to within ± .5 dB. An accurate input level is very important. A step attenuator should be inserted in the line to allow accurate fading of the input signal. Connect the transmitter RF output to the receiver RF input with the proper amount of attenuation to get a -30 dBm input level.

1. RF Module

a. Extend the RF module.

b. Tune the receiver to the transmitter.

* c. Connect an RF voltmeter to the 70 MHz output from the RF module. This is accessible in the IF module slot, at coaxial pin A3. Adjust R7 in the 70 MHz preamp for -1 dBm. See fig. 3-25.

d. Using a microwave link analyzer, adjust the differential phase and gain. This adjustment is done on the phase equalizer board. See fig. 3-21.

e. Insert the RF module.

2. IF Module

a. Extend the IF module and remove both side panels.

* b. Reduce the RF input level to -40 dBm.

[1] Initially make this adjustment with the proper test signal into the radio. Then disconnect that input and turn on the built in test tone in the control monitor. Adjust R13 on the test tone oscillator board to get 50 ua on the carrier dev. position.

[2] Make this adjustment with the AFC disabled.

* c. Using an RF voltmeter with 75 ohm termination, measure the signal strength output (E14 on the main IF card) and adjust R12 for a level of -12.8 dBm. See fig. 3-22.

d. Using an RF voltmeter with an high impedance input, on the other side of the module, measure the RF voltage on the case of Q1 on the demodulator board. The voltage should be 400mVRMS ±50 mv. If this voltage is out of tolerance, it indicates that the module needs alignment. See fig. 3-23.

e. Increase the RF level to -30 dBm.

► f. Deviate the transmitter with the proper test signal. Enable the AFC. Measure the baseband output level at the output of the invert/non-invert amplifier and adjust R56 on the demodulator board to get -2.2 dBm or .6 VP-P. See fig. 3-23.

g. Using either a microwave link analyzer or a video vectorscope, adjust to get the minimum differential phase and gain. The maximum permissible differential phase is ± .2°, and 1% differential gain. See fig. 3-21.

h. Insert the IF module.

► 3. AFC Module

a. Extend the AFC module.

b. Disable the AFC.

c. Remove the blue U-link(s). Measure the voltage from point "A" to ground and then from point "B" to ground for -7.00 VDC ± .05V. Adjust this voltage with R34. Next, measure from point "A" to point "B" and adjust R25 to get 0.00 V ± .05 V. It may be necessary to alternate between these adjustments several times to meet both specifications. Reinsert the blue U-link(s). See fig. 3-12.

d. Connect a frequency counter to the 70 MHz sample connector on the rear panel of the receiver. Normally, this level is -24 dBm. Some counters will not be able to count this low level. Disable the AFC with the front panel switch and adjust the local oscillator to read approximately 70 MHz. Enable the AFC and adjust R6 on the AFC board to get 70 MHz ± 15 KHz. See fig. 3-12.

e. Disable the AFC. Watching the meter on the AFC module, tune the local oscillator until the needle moves from center to halfway to one side. Enable the AFC. The AFC should "lock on" (that is, the needle should return to center and the fault light should go out). Disable the AFC. Tune the local oscillator in the opposite direction to get a half scale error on the other side. Enable the AFC. The AFC should lock up. Disable the AFC. Now tune the local oscillator for a full scale

error in either direction. Enable the AFC and it should not lock up. Disable the AFC. Tune for a full scale error in the opposite direction. Enable the AFC and it should not lock up.

f. Insert the AFC module.

► 4. Baseband Module

a. Extend the baseband module.

b. Insert the proper test signal into the transmitter.

c. Connect an ACVM to the baseband output. If the baseband module has a video clamper (indicated by a clamper toggle switch on the front panel of the baseband module), proceed to Step 1. If the module is not equipped with a clamper, proceed to Step 2.

(1) Adjust R1 on the video clamper board for +2.2 dBm or 1 VP-P. No adjustment is necessary on the baseband amplifier as it runs at full gain. See fig. 3-24.

(2) Adjust R1 on the baseband amplifier to get 1VP-P or +2.2 dBm out of the baseband amplifier output. See fig. 3-10.

d. Insert the baseband module.

5. Control Monitor

a. Extend the control monitor.

b. Adjust the various meter readings according to the chart below: See fig 3-17.

POT NUMBER	SWITCH FUNCTION	READING
R1	+15 V	50 ua
R20	SIG. STR.	100 ua @ -30 dBm in
R17	THRESH	50 ua
R16	DEMOD	50 ua
R13	IF OUT	50 ua
R12	CARR DEV	50 ua
R9	AFC ERR[1]	50 ua

[1] Adjust with AFC disabled.

c. Insert the control monitor module.
Before returning the radios to service, strap the following emphasis circuits back in:

CK color w/ Dev Test off

Transmitter baseband module - Pre-emphasis (fig. 3-3)

Transmitter AFC module - De-emphasis (fig. 3-11)

Receiver baseband module - De-emphasis (fig. 3-11)

Replace all side panels.

If the radio is planned to be used outside, the SMA to N adaptor should be sealed with RTV.

III. MESSAGE ALIGNMENT ADDENDUM

This addendum is intended to provide the information necessary to set proper deviation of TCM-6 telephony links. At present, there are no applicable U.S. standards, so this procedure will set deviation to CCIR standards.

A. PREREQUISITES

1. Complete the field alignment procedure.

   a. Strap the pre-emphasis flat in the transmitter baseband module. See Fig. 3-3.

   b. Strap the de-emphasis flat in the receiver baseband module. See fig. 3-11.

   c. A 1V p-p signal at the baseband input should cause 8 MHz p-p deviation.

   d. Ensure that an appropriate message amplifier is installed in the transmitter control monitor and the appropriate gain range is selected.

2. Transmitter Control Monitor

   a. Extend the control monitor.

   b. Select the appropriate test signal from Table 2-1.

   c. Apply the test signal from Table 2-1 to the baseband input. Look at the RF output on a spectrum analyzer.

   d. Adjust R5 on standard message amps (152-0206) or R1 on CCIR message amps (152-0691), to achieve a first carrier null. See fig. 3-15.

3. Receiver

a. Measure the level of the test signal at the receiver baseband output and ensure that it agrees with the appropriate level listed in Table 2-1. If necessary, adjust R1 on the baseband amplifier in the receiver baseband module to get the proper level out. See fig. 2-10.

Before returning the radios to service, strap the following emphasis circuits back in:

Transmitter baseband module: pre-emphasis (fig. 3-3).

Receiver baseband module: de-emphasis (fig. 3-11).

1	2	3	4	5	6	7	8	9	10
Maximum number of telephone traffic channels	Limits of band occupied by telephone channel (kHz)	Frequency limits of baseband (kHz)	Nominal impedance at baseband (Ω)	Relative power level per channel (dBr)				Test Signal Freq. (kHz)	CCIR Message Amp. Gain Strap
				Radio-relay system output *R*	Main repeater station		Radio-relay system input *R'*		
					T	*T'*			
24	12–108	12–108	150 bal.	−15	−23	−36	−45	117.4	
60	12–252 60–300	12–252 60–300	150 bal. 75 unbal.	−15	−23	−36	−45		E3 - E6
120	12–552 60–552	12–552 60–552	150 bal. 75 unbal.	−15	−23	−36	−45		(27dB)
300	60–1300 64–1296	60–1364	75 unbal.	−18	−23	−36	−42		
600	60–2540 64–2660	60–2792	75 unbal.	−20	−23 −33	−36 −33	−45		E4 - E6
960	60–4028 316–4188	60–4287	75 unbal.	−20	−23 −33	−36 −33	−45		(24.5dB)
1260	60–5636 60–5564 316–5564	60–5680	75 unbal.	−28	−33	−33	−37	82.2	E5 - E6
1800	312–8204 316–8204 312–8120	300–8248	75 unbal.	−28	−33	−33	−37		(15dB)
2700	312–12 388 316–12 388 312–12 336	300–12 435	75 unbal.	−28	−33	−33	−37		

Table 2-1

IV. NARROWBAND SUBCARRIER ADDENDUM

A. Prerequisites

1. The subcarrier modulator(s) is/are normally located on the left side of the transmitter baseband module. The demodulator(s) is/are normally located on the left side of the receiver baseband module.

2. Set the audio attenuators on the front panels of both the transmitter and receiver control monitors to 0 dB.

3. Connect an appropriate cable to both the audio input and the audio output. The cables are different for Channel 1 and Channel 2.

4. Connect a 400 Hertz, 0 dBm tone to the audio input (600 ohm balanced).

5. If using EIA standards, proceed to Step a. If using CCIR standards, proceed to Step b.

   a. Strap in 75 us pre-emphasis in the modulator by installing a U-link from E26-E27 (see fig. 3-28). Strap in 75 us de-emphasis in the demodulator by installing a U-link from E3-E4 (see fig. 3-29). In Step B1 below, set deviation for 100 kHz peak.

   b. Ensure that the 75 usec pre-emphasis is not strapped in by making sure that there is no U-link between E26 and E27 on the modulator (See fig. 3-28) and that there is no U-link from E3 - E4 on the demodulator (See fig. 3-29). In Step B1 below, set the deviation for 200 kHz peak.

B. Transmitter

1. Connect the modulator RF output to a modulation meter. Adjust R6 on the modulator to achieve the deviation chosen previously in Step 2. See fig. 3-28.

2. Connect the distortion meter to the modulation meter and ensure that the THD is less than 1%. If it is slightly high, R18 on the modulator may be adjusted to bring it within specification.

3. Reconnect the modulator RF output. Monitor the transmitter RF output on a spectrum analyzer. From Table 2-2 find the proper level for the subcarrier. On the summing network in the transmitter baseband module, adjust the subcarrier to get the proper level relative to the carrier (both should be unmodulated). To do this, adjust R12 for Channel 1 and R9 for Channel 2.

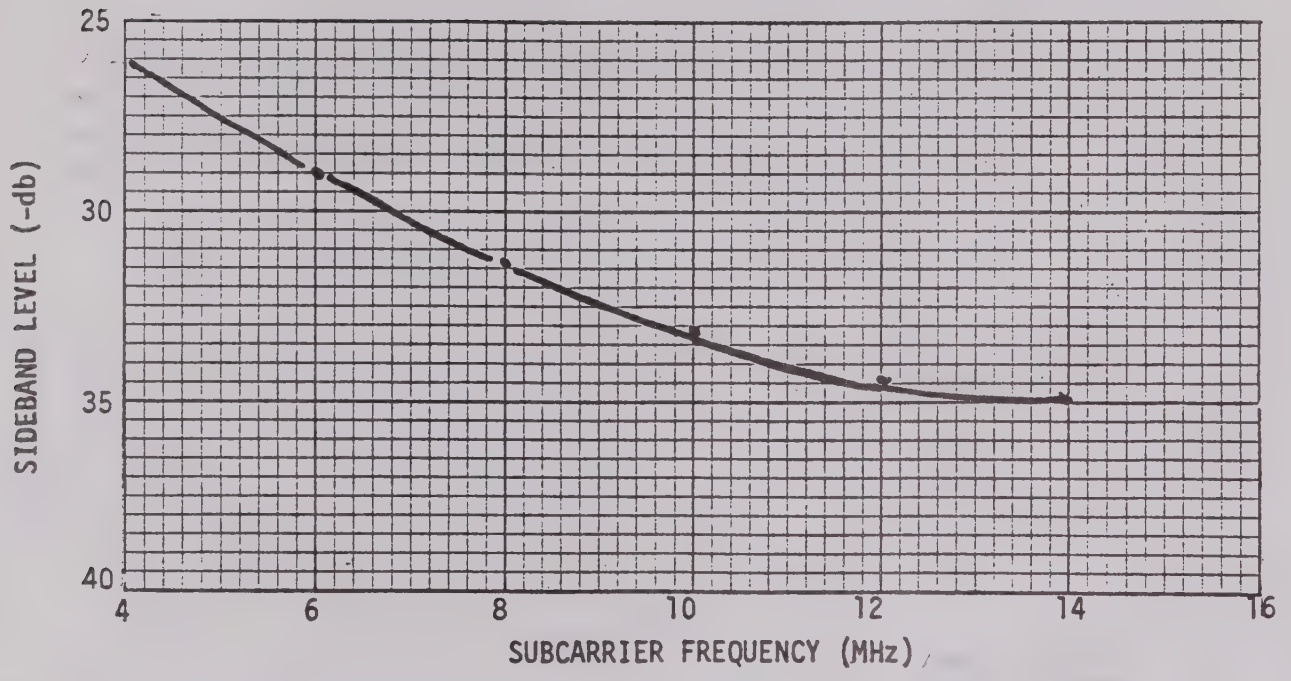


Table 2-2

C. Receiver

1. Adjust R21 on the subcarrier demodulator to get +10 dBm out. Distortion should be less than 1%.

2. Switch the audio attenator on the front panel of the transmitter to 10 dB. This establishes unity gain and 10 dB of headroom.

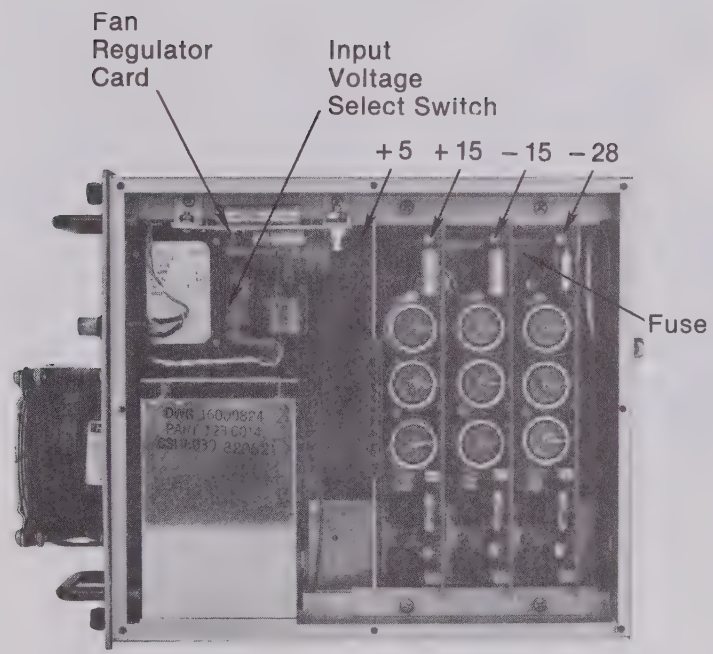


FIG. 3-1 AC POWER SUPPLY

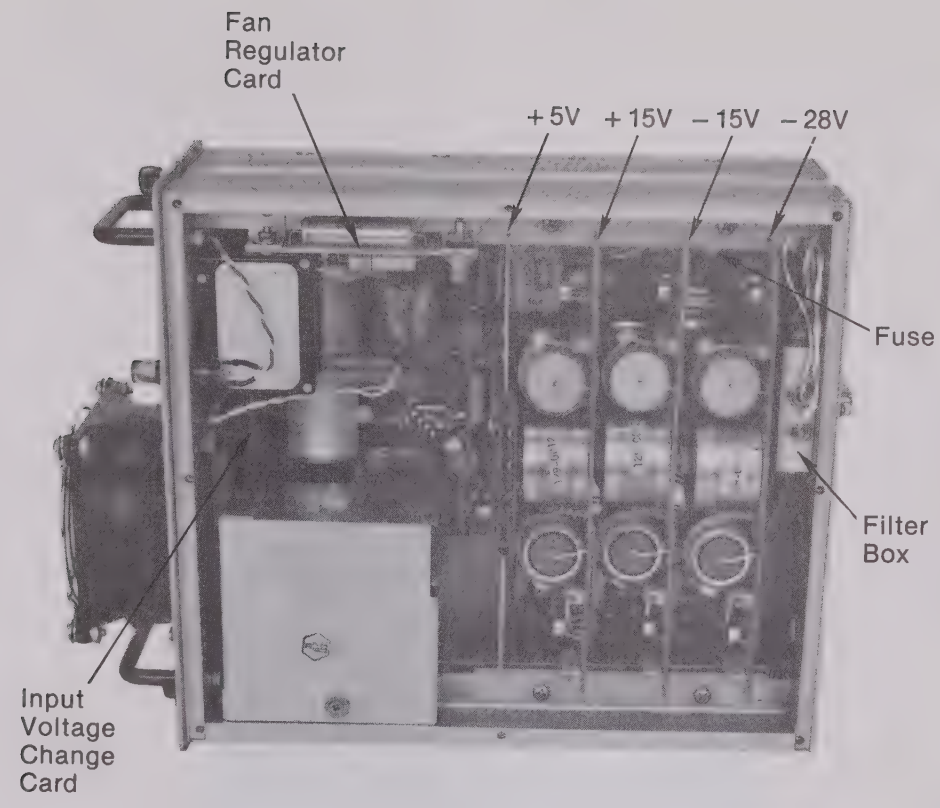
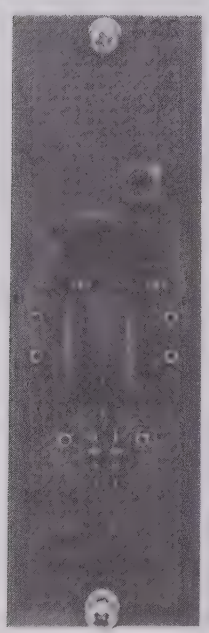
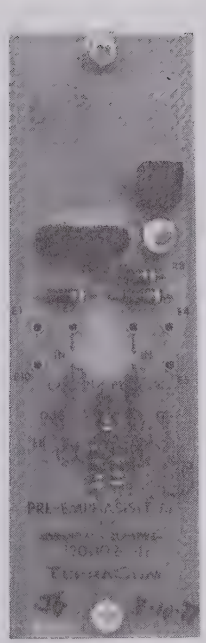


FIG. 3-2 DC POWER SUPPLY



"In"



"Out"

FIG. 3-3 PRE-EMPHASIS

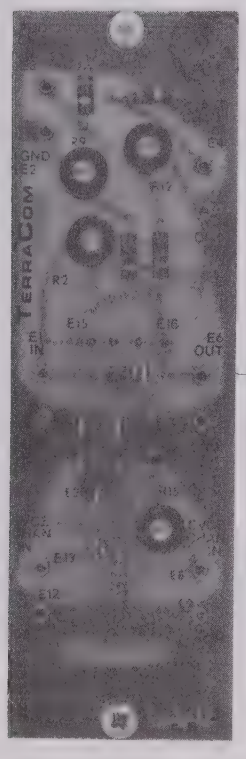


FIG. 3-4 SUMMING NETWORK

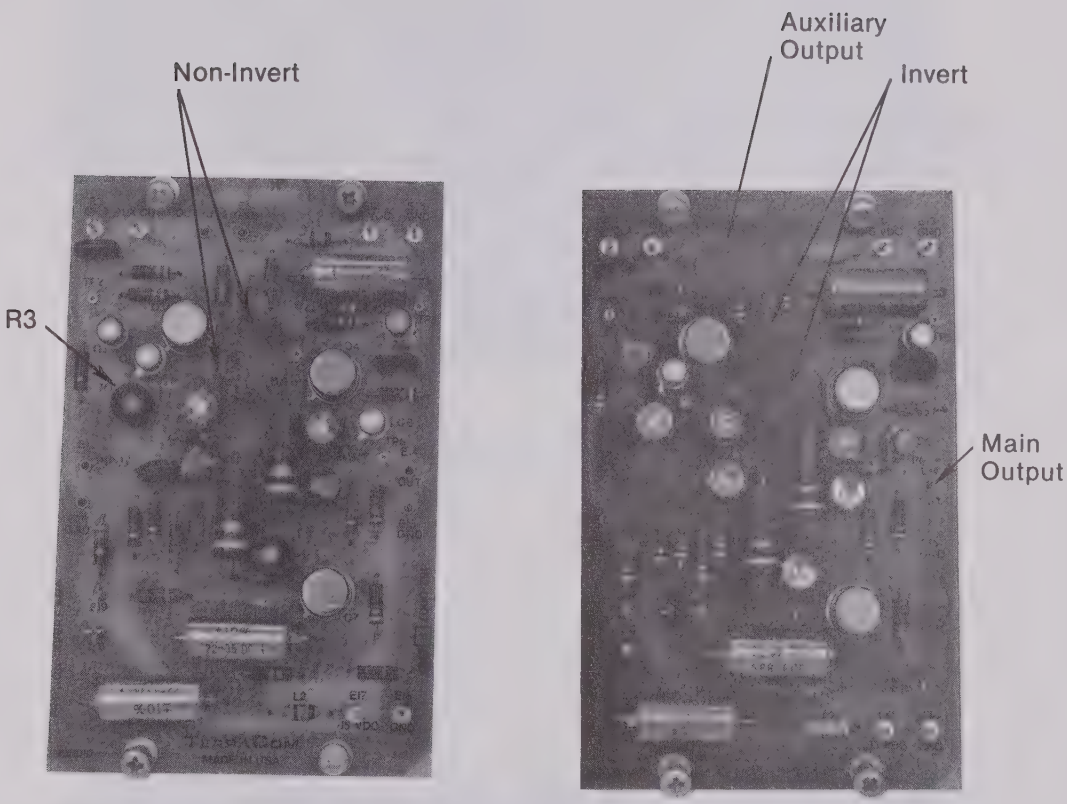


FIG. 3-5 INVERT/NON-INVERT AMP

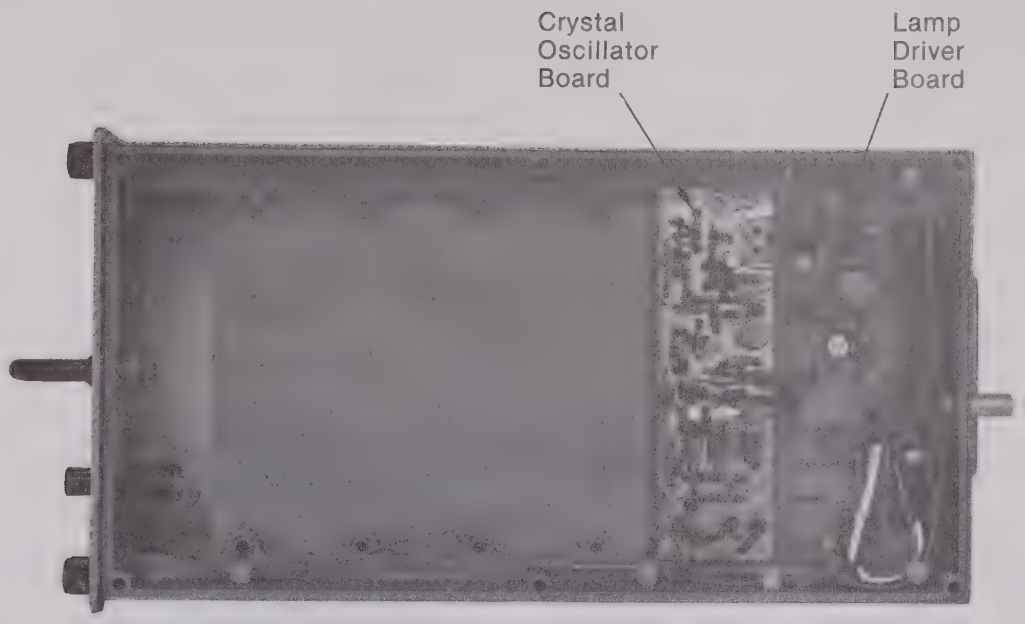


FIG. 3-6 CRYSTAL SYNTHESIZER

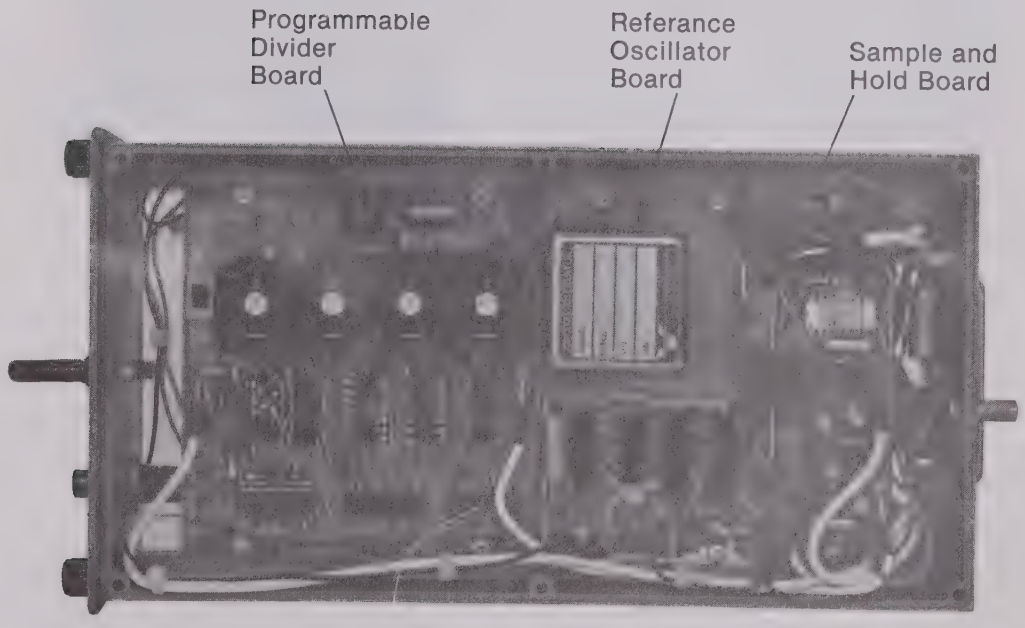


FIG. 3-7 DIGITAL SYNTHESIZER

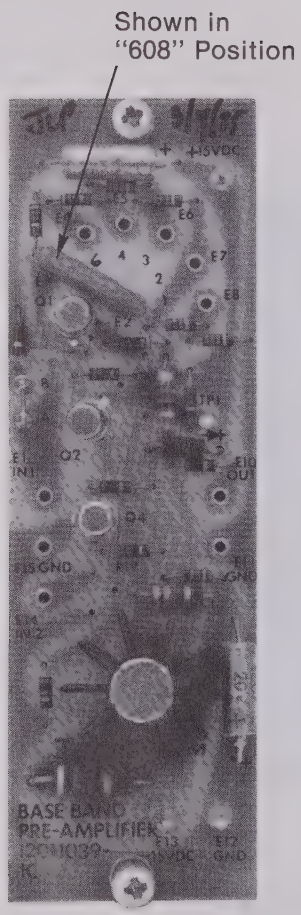


FIG. 3-8
BASEBAND PRE-AMPLIFIER

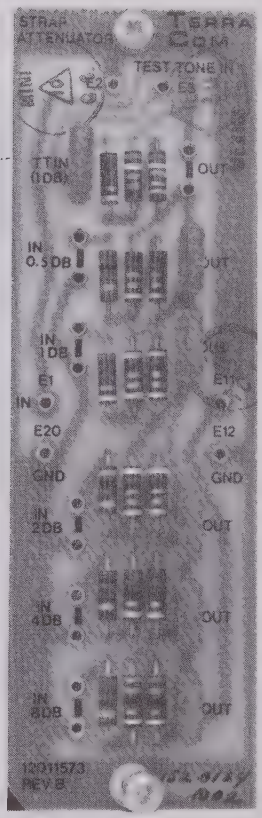


FIG. 3-9
STRAP ATTENUATOR

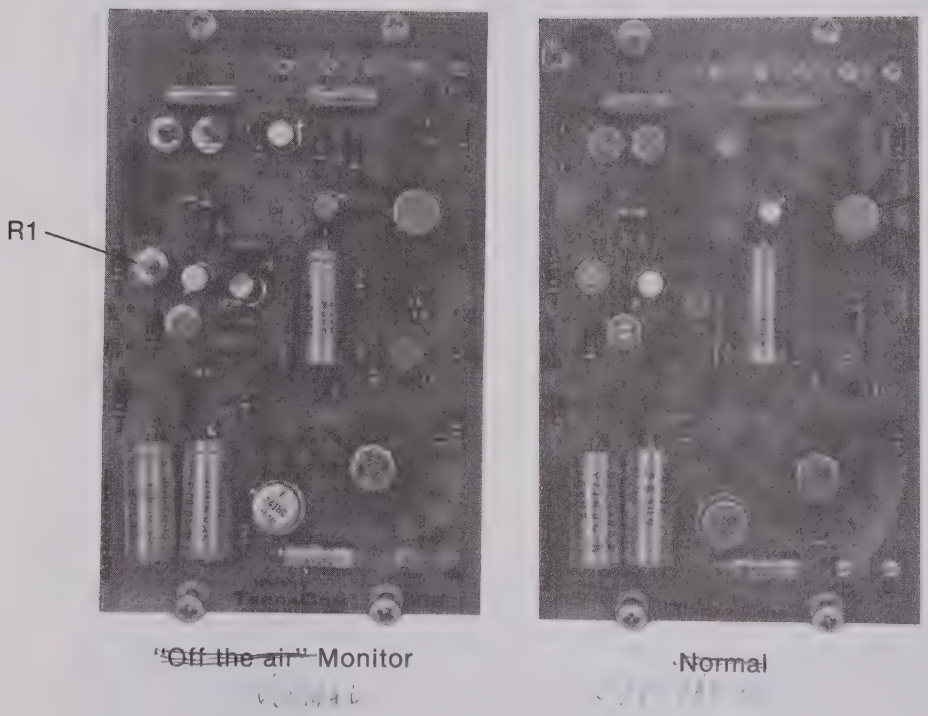
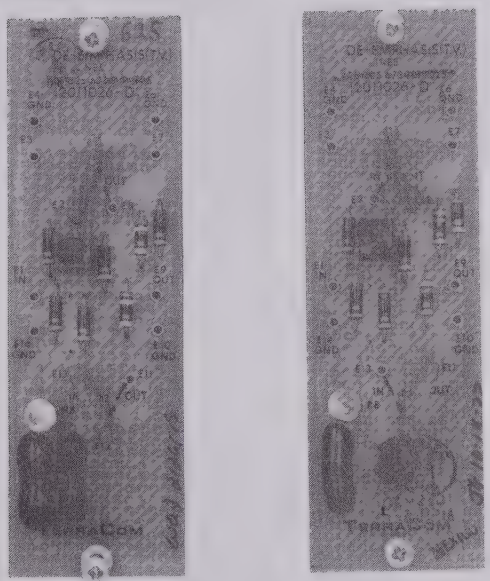


FIG. 3-10 BASEBAND AMPLIFIER



"In" "Out"

FIG. 3-11 DE-EMPHASIS

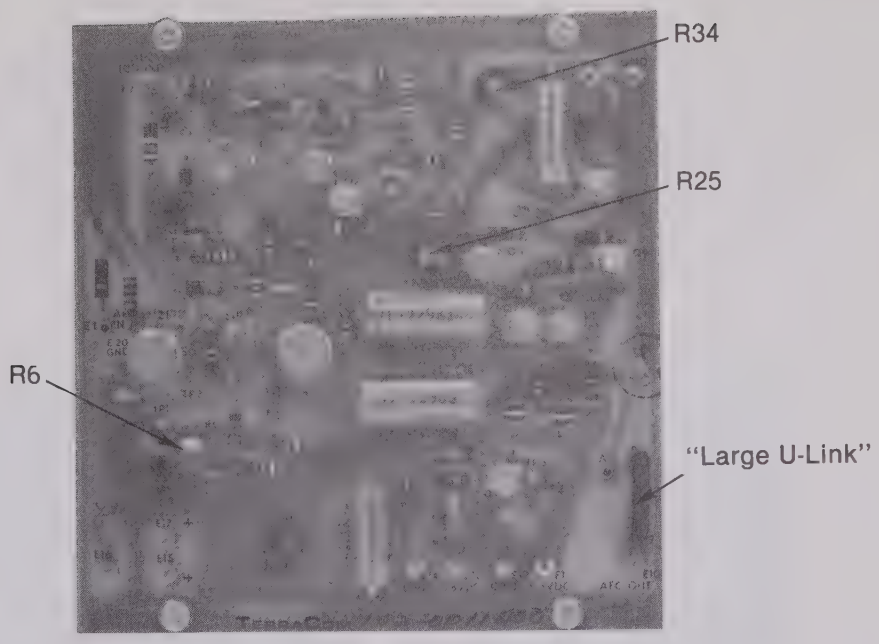


FIG. 3-12 ANALOG AFC

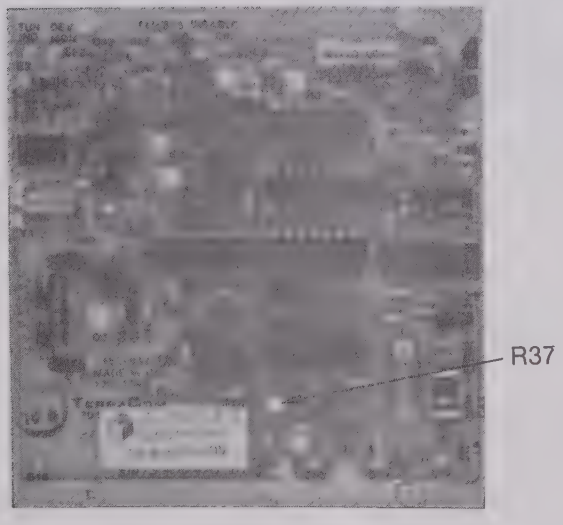


FIG. 3-13 DIGITAL AFC

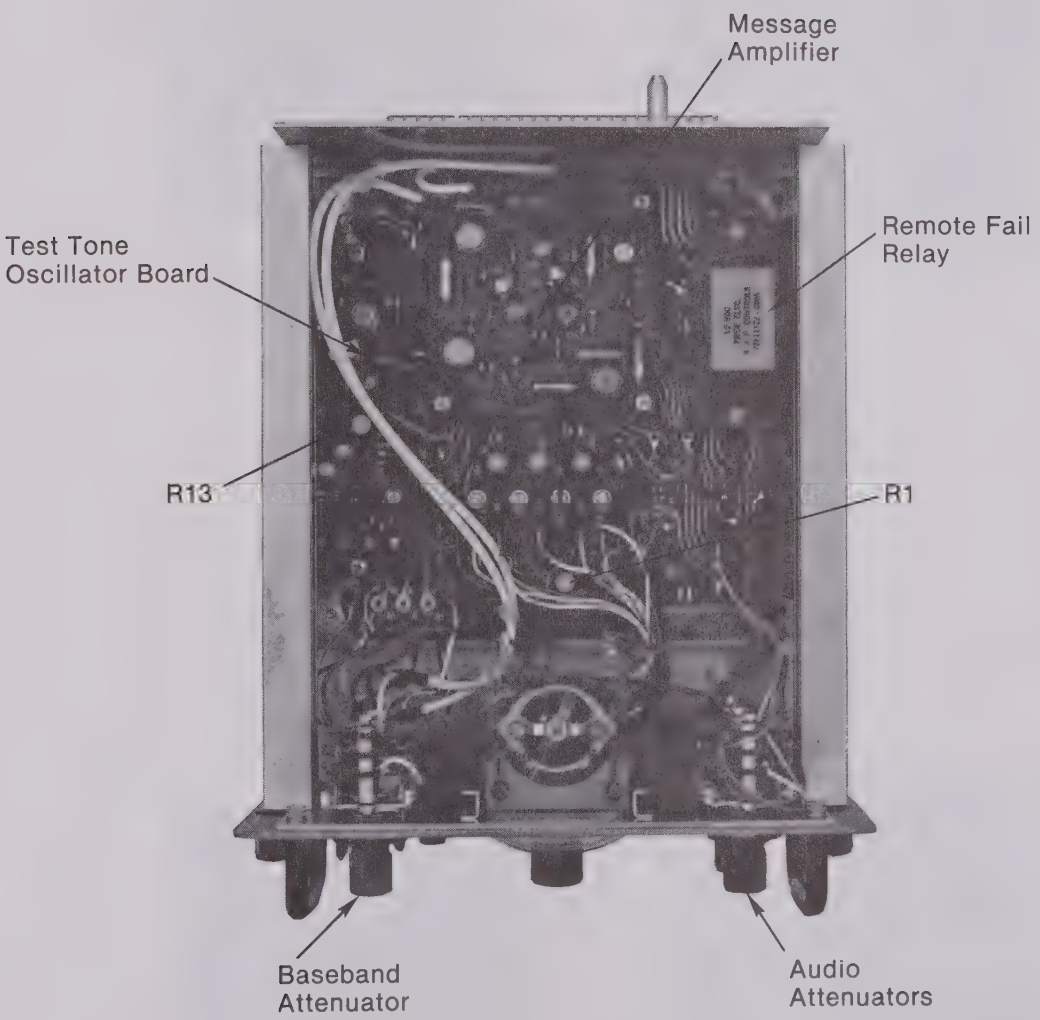
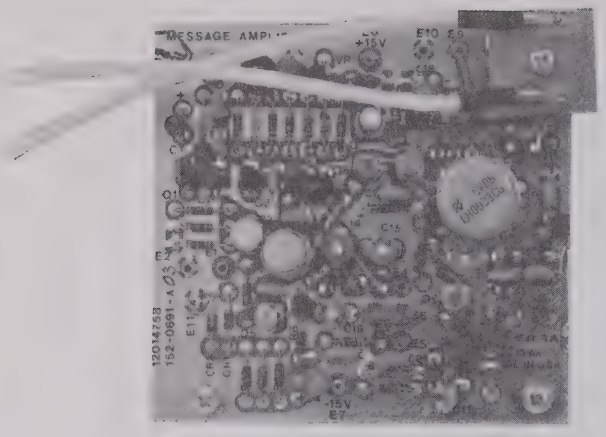
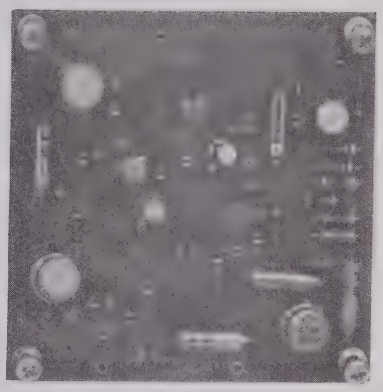


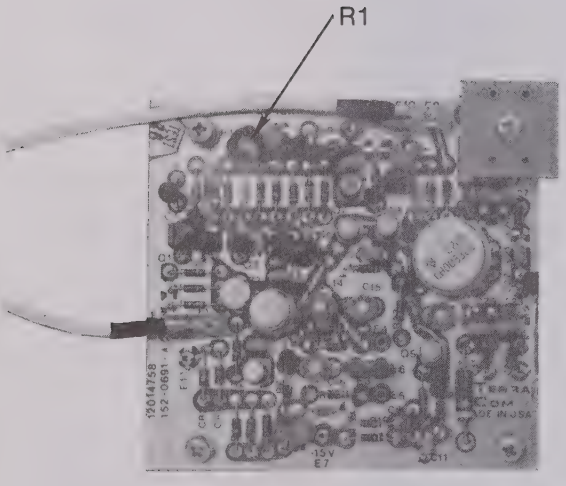
FIG. 3-14 TRANSMITTER CONTROL MONITOR



Bypassed CCIR Amp



Bypassed Standard Amp



In-circuit CCIR Amp

In-circuit Standard Amp

FIG. 3-15

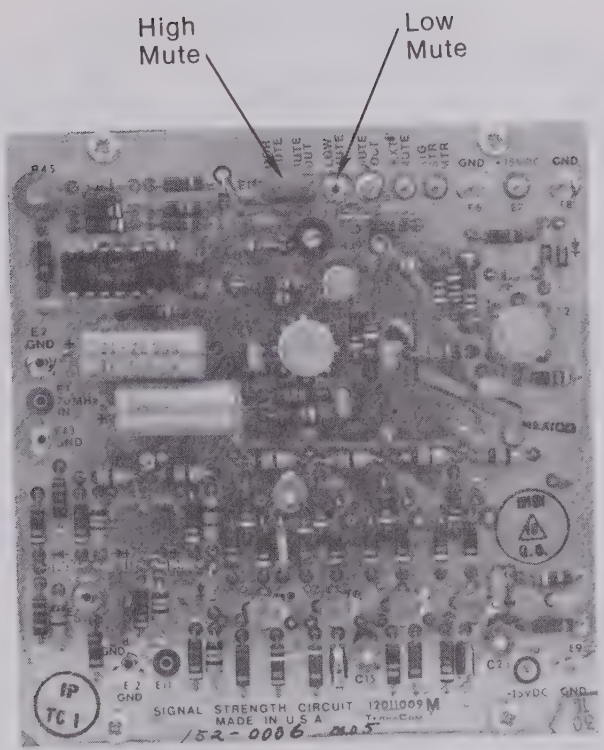


FIG. 3-16 SIGNAL STRENGTH BOARD

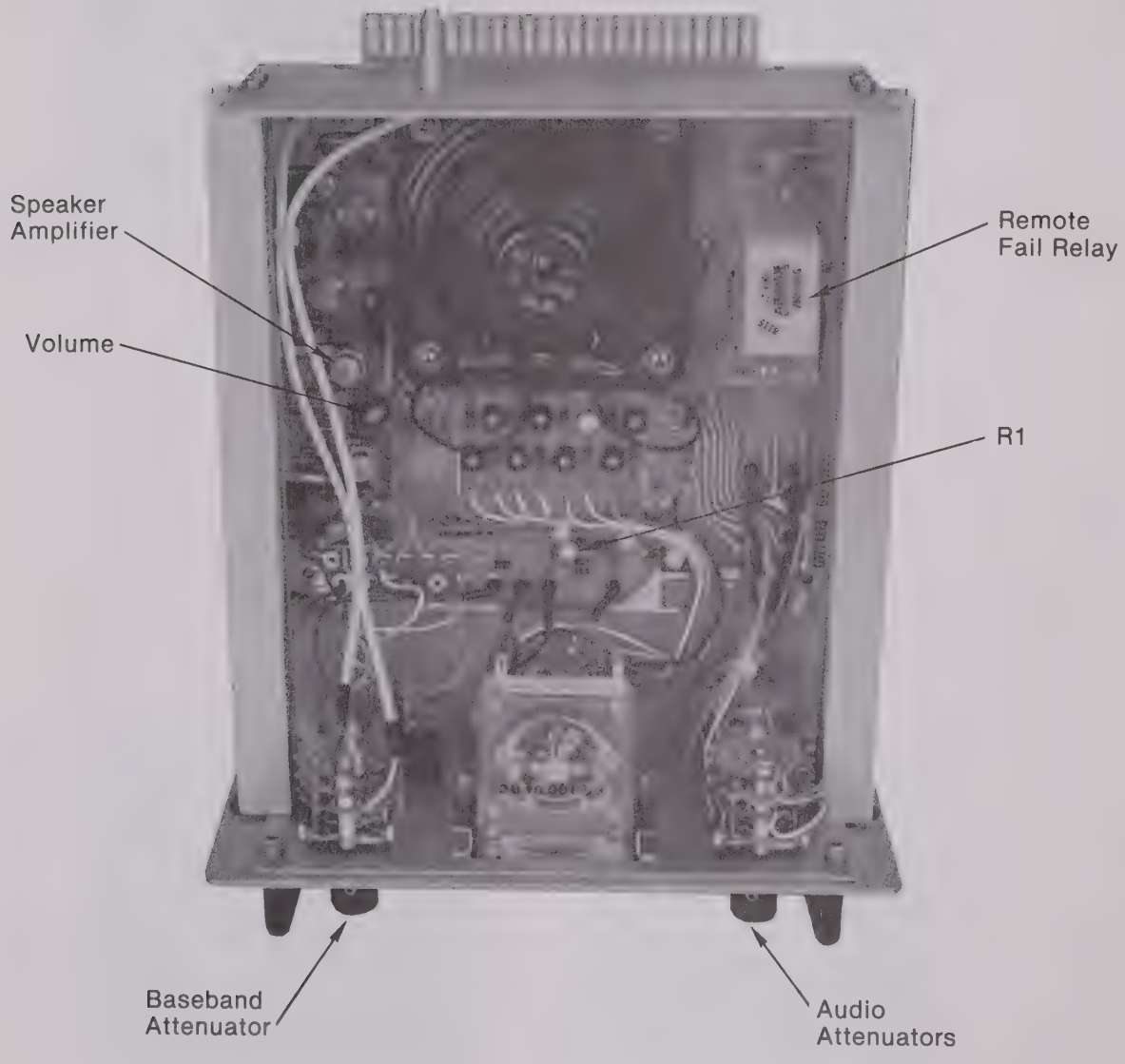


FIG. 3-17 RECEIVER CONTROL MONITOR

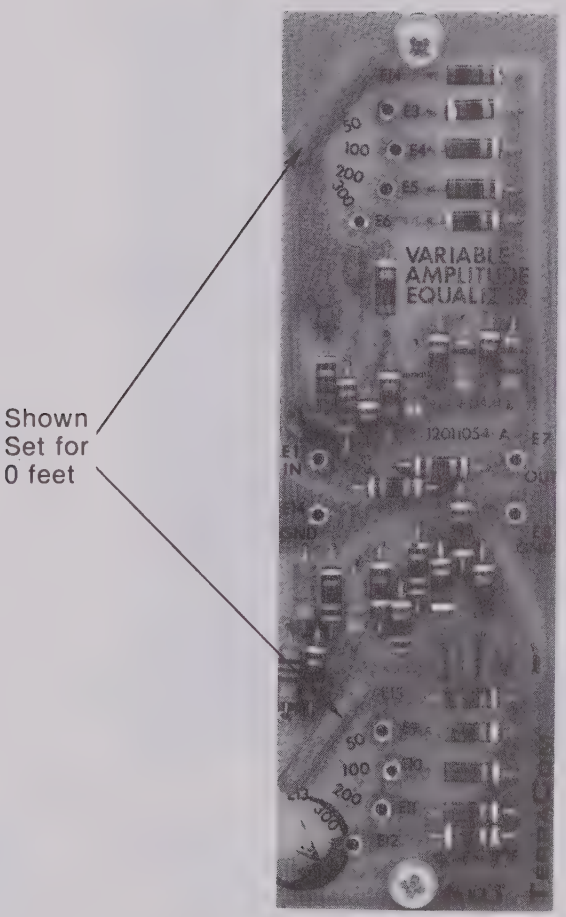


FIG. 3-18 VARIABLE AMPLITUDE EQUALIZER

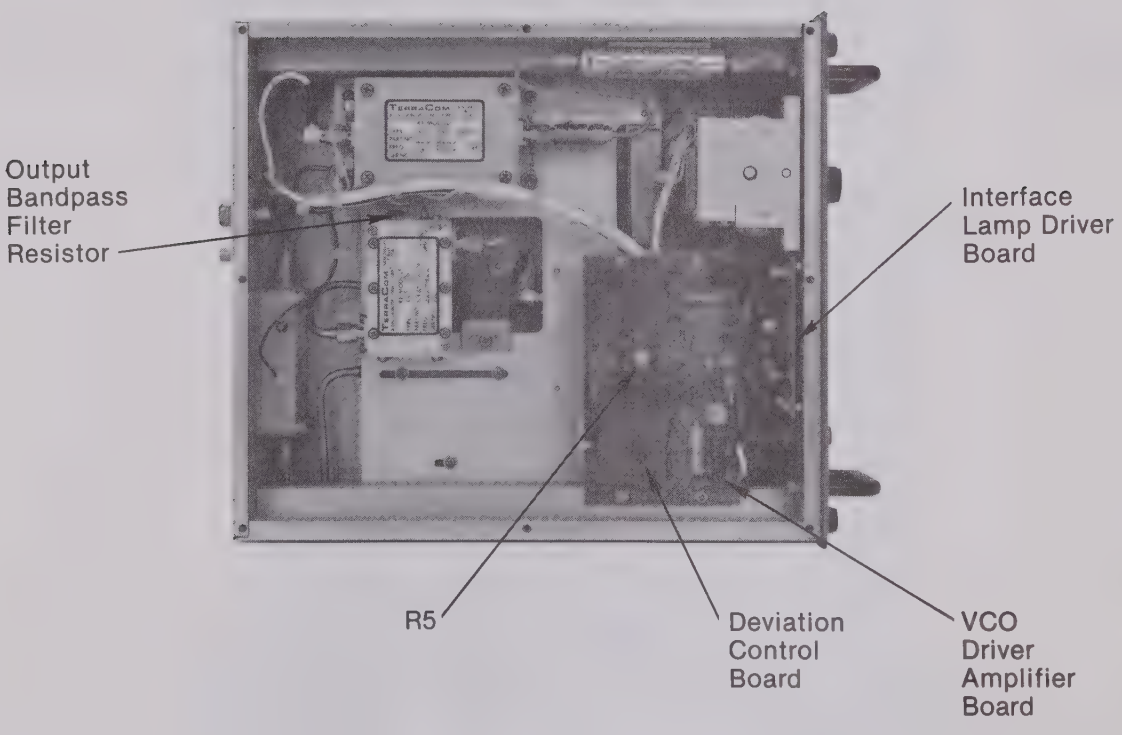


FIG. 3-19 TRANSMITTER RF MODULE

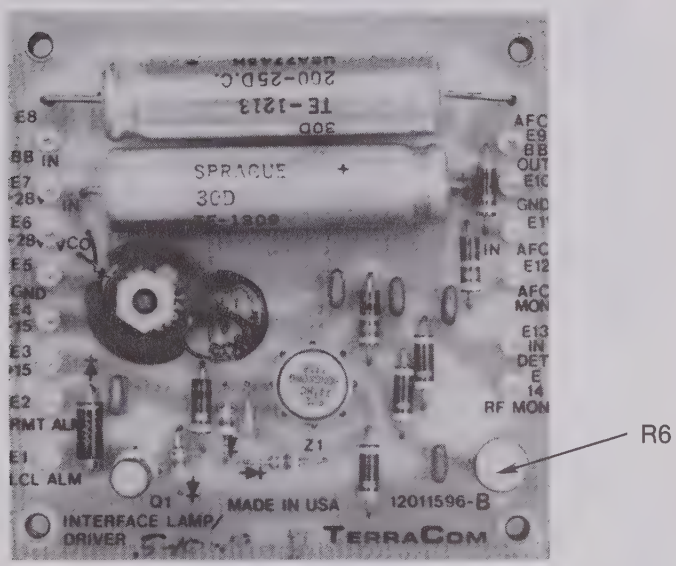


FIG. 3-20 INTERFACE LAMP DRIVER

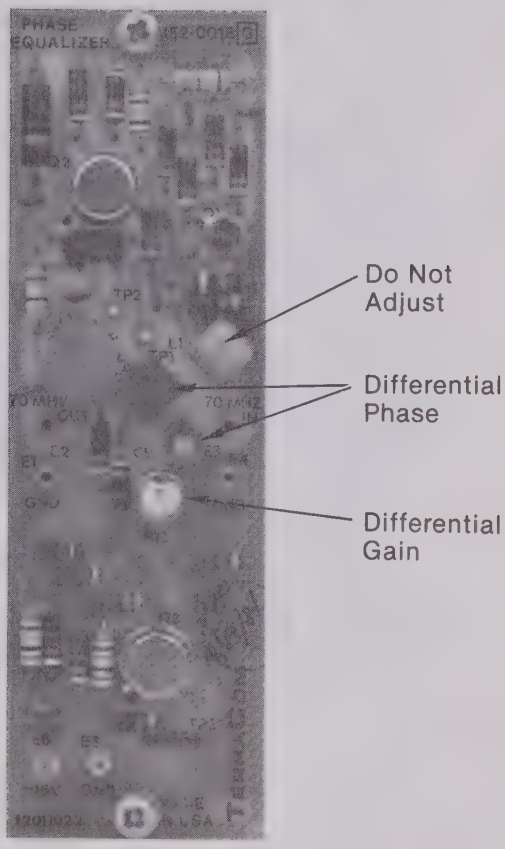


FIG. 3-21 PHASE EQUALIZER

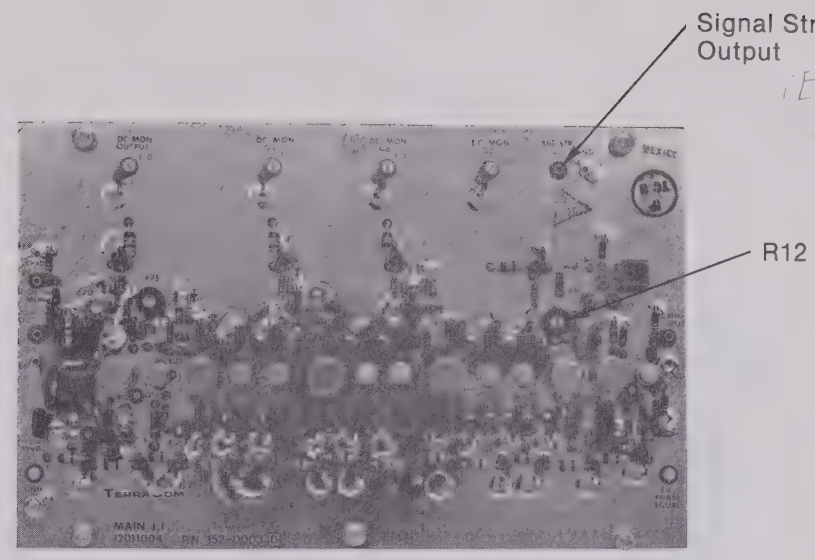


FIG. 3-22 IF AMPLIFIER

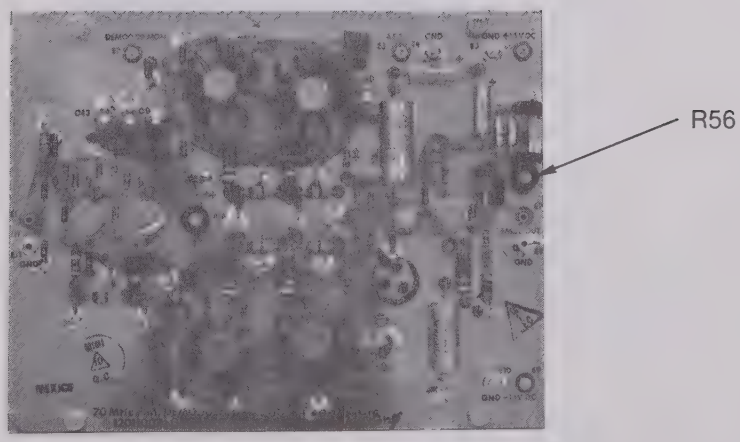


FIG. 3-23 DEMODULATOR

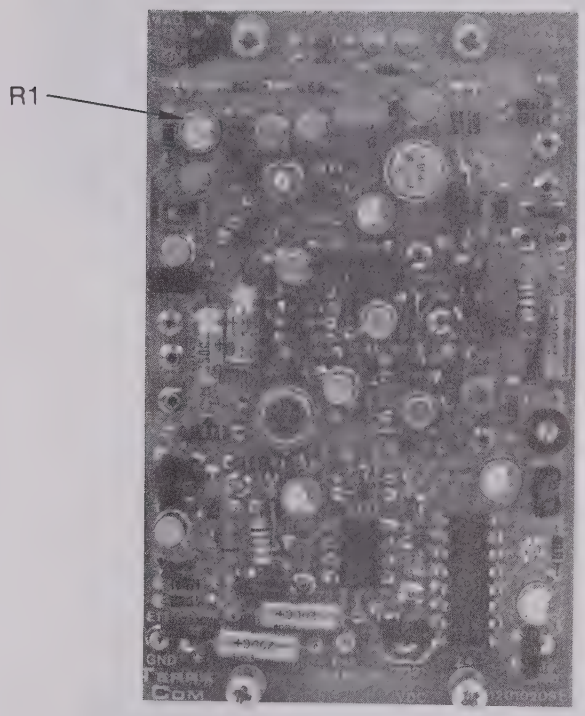


FIG. 3-24 VIDEO CLAMPER

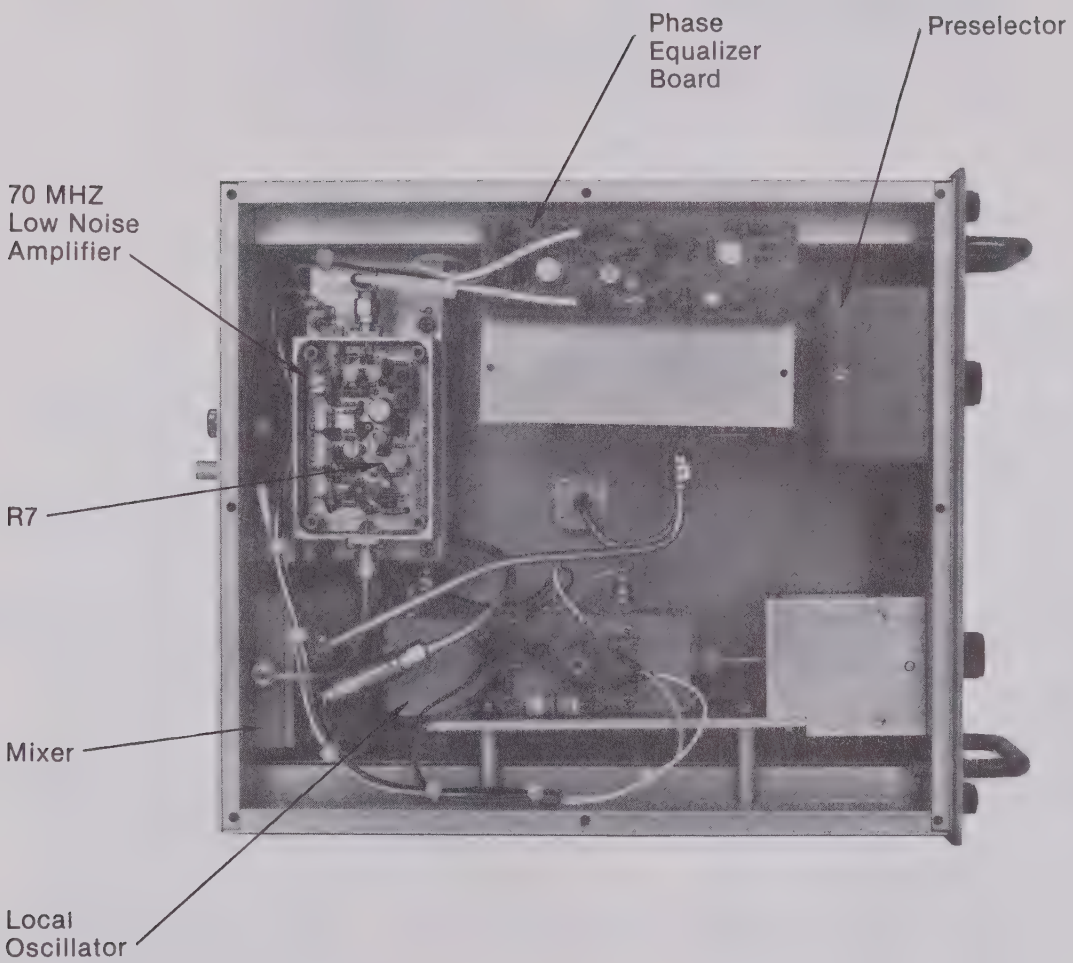
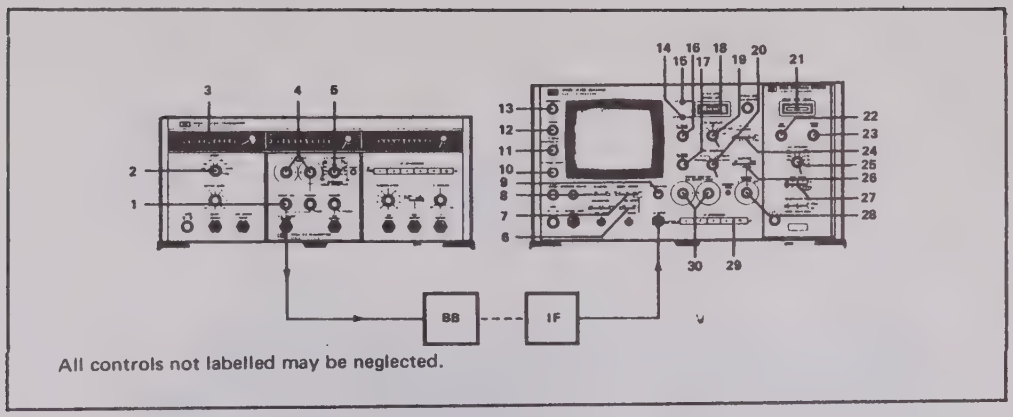


FIG. 3-25 RECEIVER RF MODULE

BB-IF MEASUREMENTS



All controls not labelled may be neglected.

1. Set the CRT controls as follows:

Y2 DISPLAY (20) .. .. IF
Y1 Y2 GAIN (16), (17) .. .. .. ccw
Y1, Y2 POSITION (16), (17) .. mid pos

Adjust the INTENSITY control (13) until two spots just appear, adjust the FOCUS (12) and ASTIGMATISM (rear panel) controls for two round sharp spots.

Set the Y2 DISPLAY switch (20) to SPECTRUM and adjust the X GAIN (11) and X POSITION (9) controls for a 10cm display. Adjust the TRACE ALIGN (rear panel) control to align the traces parallel to the horizontal graticule lines.

2. Set the MLA controls as follows:

SWEEP CAL (1) .. .. ccw
SWEEP (2) .. .. normally INT
SWEEP WIDTH (3) .. .. as required
BB FREQUENCY (5) .. .. .. any low frequency
BB INPUT (6) .. .. INT
SWEEP SOURCE (7) .. .. INT IF
BLANKING (8) .. .. OFF
Y1 DISPLAY (19) .. .. IF
Y2 DISPLAY (20) .. .. IF
Y1 Y2 CALIBRATION (24) .. .. OFF
BB FREQUENCY (25) .. .. same as (5)
MARKERS (26) .. .. SLIDING
MARKER OFFSET (28) .. .. . as Sweep Width

3. Set the Transmitter BB POWER attenuator (4) for the required drive level into the BB input of the test item.

4. Connect the 75 ohm cabling as shown in the diagram.

5. Adjust the Receiver IF ATTENUATOR (29) for an on-scale reading on the IF LEVEL meter (18). Ensure that the AFC LOCK lamp (14) is lit and the IF UNCAL lamp (15) is extinguished.

6. Set the Y1 DISPLAY switch (19) to BB, and adjust the Receiver BB POWER attenuator (30) for an on-scale reading on the BB LEVEL meter (18).

7. Turn the SWEEP CAL control (1) slowly clockwise until the sliding markers just appear at the trace edges.

8. Adjust the X PHASE SHIFT control (10) to superimpose the markers on the forward and return traces. Reset the BLANKING switch (8) to ON.

9. Adjust the X GAIN control (11) for a 10cm trace width.

NOTE: The SWEEP WIDTH control (3) is now calibrated for the modulator under test therefore to change the IF range out of the modulator, set the SWEEP WIDTH control (3) to the desired setting.

If the IF UNCAL lamp (15) lights during adjustments, then recheck the IF level. Set the Y1 DISPLAY switch (19) to IF and adjust the Receiver IF ATTENUATOR (29) for an on-scale reading on the IF LEVEL meter (18). Reset the Y1 DISPLAY switch (19) to BB.

DIFFERENTIAL GAIN AND DIFFERENTIAL PHASE

A simultaneous display of differential gain and differential phase can be obtained with the Y1 DISPLAY switch (19) set to BB, and the Y2 DISPLAY switch (20) set to DELAY.

The BB FREQUENCY switches (5) and (25) must be set to the same frequency, which should be greater than 500kHz (555ΔkHz). Adjust the BB POWER attenuator (30) for an on-scale reading on the BB LEVEL meter (18).

To calibrate the Y1 trace, select a suitable calibration factor on the Y1 Y2 CALIBRATION switch (24) and adjust the Y1 GAIN control (16) for the required sensitivity. Reset the Y1 Y2 CALIBRATION switch (24) to OFF.

To calibrate the Y2 trace, adjust the SET LEVEL control (22) fully clockwise and adjust the PHASE LOCK control (23) for an up-scale deflection on the PHASE LOCK/LEVEL meter (21). Readjust the SET LEVEL control (22) for a reading within the green band of the PHASE LOCK/LEVEL meter (21). Adjust the PHASE LOCK control (23) for a peak on the PHASE LOCK/LEVEL meter (21). If necessary readjust the SET LEVEL control (22) for a reading with the green band of the PHASE LOCK/LEVEL meter (21). Set the DIFF PHASE CALIBRATION switch (27) to a suitable calibration factor, and adjust the Y2 GAIN control (17) for the required sensitivity. Reset the DIFF PHASE CALIBRATION switch (27) to OFF.

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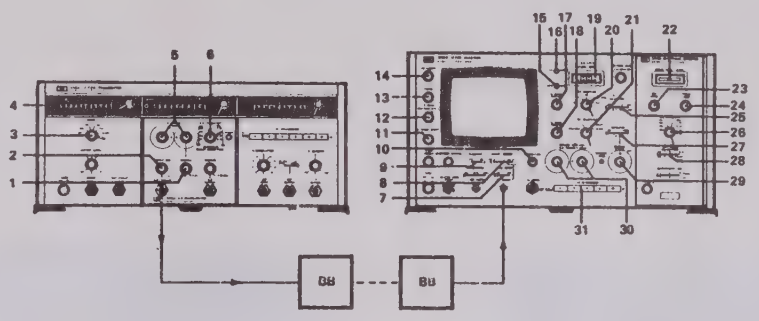
Fig. 3-26

BB-BB MEASUREMENTS



All controls not labelled may be neglected.

1. Set the CRT controls as follows:

Y2 DISPLAY (21) .. .. IF
Y1, Y2 GAIN (17), (18) .. .. .. ccw
Y1, Y2 POSITION (17), (18) .. mid pos

Adjust the INTENSITY control (14) until two spots just appear, adjust the FOCUS (13) and ASTIGMATISM (rear panel) controls for two round sharp spots.

Set the Y2 DISPLAY switch (21) to SPECTRUM and adjust the X GAIN (12) and X POSITION (10) controls for a 10cm display. Adjust the TRACE ALIGN (rear panel) control to align the traces parallel to the horizontal graticule lines.

2. Set the MLA controls as follows:

BB + SWEEP VERNIER (1) .. .. CAL
SWEEP CAL (2) .. .. ccw
SWEEP (3) .. .. normally INT
SWEEP WIDTH (4) .. .. as required
BB FREQUENCY (6) .. .. as required
BB INPUT (7) .. .. EXT
SWEEP SOURCE (8) .. .. INT IF
BLANKING (9) .. .. ON
Y1 DISPLAY (20) .. .. IF
Y2 DISPLAY (21) .. .. DELAY
Y1 Y2 CALIBRATION (25) .. .. OFF
BB FREQUENCY (26) .. .. same as (6)
MARKERS (27) .. .. SLIDING
MARKER OFFSET (29) .. .. .. as Sweep Width

3. Set the Transmitter BB POWER attenuator (5) for the required drive level into the test item.

4. Connect the 75 ohm cabling as shown in the diagram.

DIFFERENTIAL GAIN AND DIFFERENTIAL PHASE

A simultaneous display of differential gain and differential phase can be obtained with the Y1 DISPLAY switch (20) set to BB and the Y2 DISPLAY switch (21) set to DELAY. The BB FREQUENCY switches (6) and (26) must be set to the same frequency, which should be greater than 500kHz (555ΔkHz).

To calibrate the Y1 trace, select a suitable calibration factor on the Y1 Y2 CALIBRATION switch (25) and adjust the Y1 GAIN control (17) for the required sensitivity. Reset the Y1 Y2 CALIBRATION switch (25) to OFF.

To calibrate the Y2 trace, adjust the SET LEVEL control (23) fully clockwise and adjust the PHASE LOCK control (24) for an up-scale deflection on the PHASE LOCK/LEVEL meter (22). Readjust the SET LEVEL control (23) for a reading within the green band of the PHASE LOCK/LEVEL meter (22). Adjust the PHASE LOCK control (24) for a peak on the PHASE LOCK/LEVEL meter (22) If necessary, readjust the SET LEVEL control (23) for a reading within the green band of the PHASE LOCK/LEVEL meter (22). Set the DIFF PHASE CALIBRATION switch (28) to a suitable calibration factor, and adjust the Y2 GAIN control (18) for the required sensitivity. Reset the DIFF PHASE CALIBRATION switch (28) to OFF.

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Fig. 3-27

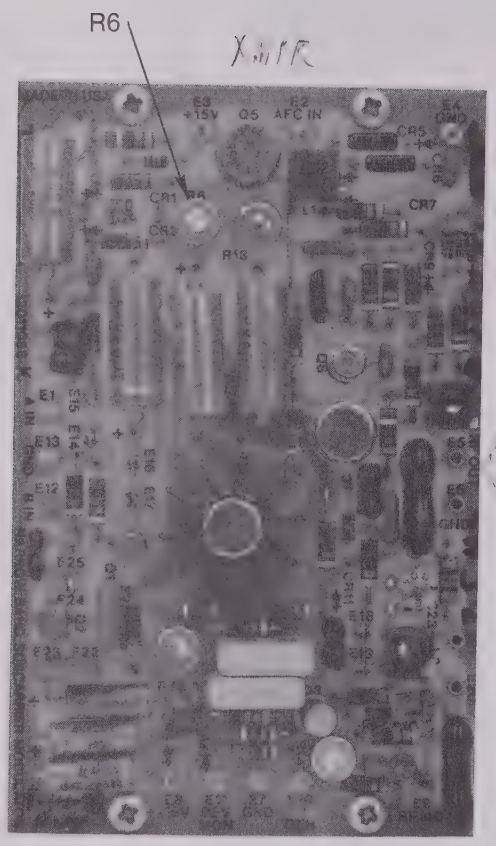

FIG. 3-28 PROGRAM CHANNEL MODULATOR

FIG. 3-29 PROGRAM CHANNEL DEMODULATOR

SYNTHESIZER FREQUENCIES, TCM-601

	0	1	2	3	4	5	6	7	8	9
1700	95.882	95.941	96.000	96.059	96.118	96.176	96.235	96.294	96.353	96.412
1710	96.471	96.529	96.588	96.647	96.706	96.765	96.824	96.882	96.941	97.000
1720	97.059	97.118	97.176	97.235	97.294	97.353	97.412	97.471	97.529	97.588
1730	97.647	97.706	97.765	97.824	97.882	97.941	98.000	98.059	98.118	98.176
1740	98.235	98.294	98.353	98.412	98.471	98.529	98.588	98.647	98.706	98.765
1750	98.824	98.882	98.941	99.000	99.059	99.118	99.176	99.235	99.294	99.353
1760	99.412	99.471	99.529	99.588	99.647	99.706	99.765	99.824	99.882	99.941
1770	100.000	100.059	100.118	100.176	100.235	100.294	100.353	100.412	100.471	100.529
1780	100.588	100.647	100.706	100.765	95.222	95.278	95.333	95.389	95.444	95.500
1790	95.556	95.611	95.667	95.722	95.778	95.833	95.889	95.944	96.000	96.056
1800	96.111	96.167	96.222	96.278	96.333	96.389	96.444	96.500	96.556	96.611
1810	96.667	96.722	96.778	96.833	96.889	96.944	97.000	97.056	97.111	97.167
1820	97.222	97.278	97.333	97.389	97.444	97.500	97.556	97.611	97.667	97.722
1830	97.778	97.833	97.889	97.944	98.000	98.056	98.111	98.167	98.222	98.278
1840	98.333	98.389	98.444	98.500	98.556	98.611	98.667	98.722	98.778	98.833
1850	98.889	98.944	99.000	99.056	99.111	99.167	99.222	99.278	99.333	99.389
1860	99.444	99.500	99.556	99.611	99.667	99.722	99.778	99.833	99.889	99.944
1870	100.000	100.056	100.111	100.167	100.222	100.278	100.333	100.389	100.444	100.500
1880	100.556	100.611	95.368	95.421	95.474	95.526	95.579	95.632	95.684	95.737
1890	95.789	95.842	95.895	95.947	96.000	96.053	96.105	96.158	96.211	96.263
1900	96.316	96.368	96.421	96.474	96.526	96.579	96.632	96.684	96.737	96.789
1910	96.842	96.895	96.947	97.000	97.053	97.105	97.158	97.211	97.263	97.316
1920	97.368	97.421	97.474	97.526	97.579	97.632	97.684	97.737	97.789	97.842
1930	97.895	97.947	98.000	98.053	98.105	98.158	98.211	98.263	98.316	98.368
1940	98.421	98.474	98.526	98.579	98.632	98.684	98.737	98.789	98.842	98.895
1950	98.947	99.000	99.053	99.105	99.158	99.211	99.263	99.316	99.368	99.421
1960	99.474	99.526	99.579	99.632	99.684	99.737	99.789	99.842	99.895	99.947
1970	100.000	100.053	100.105	100.158	100.211	100.263	100.316	100.368	100.421	100.474
1980	95.500	95.550	95.600	95.650	95.700	95.750	95.800	95.850	95.900	95.950
1990	96.000	96.050	96.100	96.150	96.200	96.250	96.300	96.350	96.400	96.450
2000	96.500	96.550	96.600	96.650	96.700	96.750	96.800	96.850	96.900	96.950
2010	97.000	97.050	97.100	97.150	97.200	97.250	97.300	97.350	97.400	97.450
2020	97.500	97.550	97.600	97.650	97.700	97.750	97.800	97.850	97.900	97.950
2030	98.000	98.050	98.100	98.150	98.200	98.250	98.300	98.350	98.400	98.450
2040	98.500	98.550	98.600	98.650	98.700	98.750	98.800	98.850	98.900	98.950
2050	99.000	99.050	99.100	99.150	99.200	99.250	99.300	99.350	99.400	99.450
2060	99.500	99.550	99.600	99.650	99.700	99.750	99.800	99.850	99.900	99.950
2070	100.000	100.050	100.100	100.150	100.200	100.250	100.300	100.350	95.619	95.667
2080	95.714	95.762	95.810	95.857	95.905	95.952	96.000	96.048	96.095	96.143
2090	96.190	96.238	96.286	96.333	96.381	96.429	96.476	96.524	96.571	96.619
2100	96.667	96.714	96.762	96.810	96.857	96.905	96.952	97.000	97.048	97.095
2110	97.143	97.190	97.238	97.286	97.333	97.381	97.429	97.476	97.524	97.571
2120	97.619	97.667	97.714	97.762	97.810	97.857	97.905	97.952	98.000	98.048
2130	98.095	98.143	98.190	98.238	98.286	98.333	98.381	98.429	98.476	98.524
2140	98.571	98.619	98.667	98.714	98.762	98.810	98.857	98.905	98.952	99.000
2150	99.048	99.095	99.143	99.190	99.238	99.286	99.333	99.381	99.429	99.476
2160	99.524	99.571	99.619	99.667	99.714	99.762	99.810	99.857	99.905	99.952
2170	100.000	100.048	100.095	100.143	100.190	100.238	95.727	95.773	95.818	95.864
2180	95.909	95.955	96.000	96.045	96.091	96.136	96.182	96.227	96.273	96.318
2190	96.364	96.409	96.455	96.500	96.545	96.591	96.636	96.682	96.727	96.773

SYNTHESIZER FREQUENCIES, TCM-601

	0	1	2	3	4	5	6	7	8	9
2200	96.818	96.864	96.909	96.955	97.000	97.045	97.091	97.136	97.182	97.227
2210	97.273	97.318	97.364	97.409	97.455	97.500	97.545	97.591	97.636	97.682
2220	97.727	97.773	97.818	97.864	97.909	97.955	98.000	98.045	98.091	98.136
2230	98.182	98.227	98.273	98.318	98.364	98.409	98.455	98.500	98.545	98.591
2240	98.636	98.682	98.727	98.773	98.818	98.864	98.909	98.955	99.000	99.045
2250	99.091	99.136	99.182	99.227	99.273	99.318	99.364	99.409	99.455	99.500
2260	99.545	99.591	99.636	99.682	99.727	99.773	99.818	99.864	99.909	99.955
2270	100.000	100.045	100.091	100.136	95.826	95.870	95.913	95.957	96.000	96.043
2280	96.087	96.130	96.174	96.217	96.261	96.304	96.348	96.391	96.435	96.478
2290	96.522	96.565	96.609	96.652	96.696	96.739	96.783	96.826	96.870	96.913
2300	96.957	97.000	97.043	97.087	97.130	97.174	97.217	97.261	97.304	97.348
2310	97.391	97.435	97.478	97.522	97.565	97.609	97.652	97.696	97.739	97.783
2320	97.826	97.870	97.913	97.957	98.000	98.043	98.087	98.130	98.174	98.217
2330	98.261	98.304	98.348	98.391	98.435	98.478	98.522	98.565	98.609	98.652
2340	98.696	98.739	98.783	98.826	98.870	98.913	98.957	99.000	99.043	99.087
2350	99.130	99.174	99.217	99.261	99.304	99.348	99.391	99.435	99.478	99.522
2360	99.565	99.609	99.652	99.696	99.739	99.783	99.826	99.870	99.913	99.957
2370	100.000	100.043	95.917	95.958	96.000	96.042	96.083	96.125	96.167	96.208
2380	96.250	96.292	96.333	96.375	96.417	96.458	96.500	96.542	96.583	96.625
2390	96.667	96.708	96.750	96.792	96.833	96.875	96.917	96.958	97.000	97.042
2400	97.083	97.125	97.167	97.208	97.250	97.292	97.333	97.375	97.417	97.458
2410	97.500	97.542	97.583	97.625	97.667	97.708	97.750	97.792	97.833	97.875
2420	97.917	97.958	98.000	98.042	98.083	98.125	98.167	98.208	98.250	98.292
2430	98.333	98.375	98.417	98.458	98.500	98.542	98.583	98.625	98.667	98.708
2440	98.750	98.792	98.833	98.875	98.917	98.958	99.000	99.042	99.083	99.125
2450	99.167	99.208	99.250	99.292	99.333	99.375	99.417	99.458	99.500	99.542
2460	99.583	99.625	99.667	99.708	99.750	99.792	99.833	99.875	99.917	99.958
2470	96.000	96.040	96.080	96.120	96.160	96.200	96.240	96.280	96.320	96.360
2480	96.400	96.440	96.480	96.520	96.560	96.600	96.640	96.680	96.720	96.760
2490	96.800	96.840	96.880	96.920	96.960	97.000	97.040	97.080	97.120	97.160
2500	97.200	97.240	97.280	97.320	97.360	97.400	97.440	97.480	97.520	97.560

SYNTHESIZER FREQUENCIES, TCM-602

	0	1	2	3	4	5	6	7	8	9
2450	96.250	96.292	96.333	96.375	96.417	96.458	96.500	96.542	96.583	96.625
2460	96.667	96.708	96.750	96.792	96.833	96.875	96.917	96.958	97.000	97.042
2470	97.083	97.125	97.167	97.208	97.250	97.292	97.333	97.375	97.417	97.458
2480	97.500	97.542	97.583	97.625	97.667	97.708	97.750	97.792	97.833	97.875
2490	97.917	97.958	98.000	98.042	98.083	98.125	98.167	98.208	98.250	98.292
2500	98.333	98.375	98.417	98.458	98.500	98.542	98.583	98.625	98.667	98.708
2510	98.750	98.792	98.833	98.875	98.917	98.958	99.000	99.042	99.083	99.125
2520	99.167	99.208	99.250	99.292	99.333	99.375	99.417	99.458	99.500	99.542
2530	99.583	99.625	99.667	99.708	99.750	99.792	99.833	99.875	99.917	99.958
2540	100.000	100.042	100.083	100.125	100.167	100.208	100.250	100.292	100.333	100.375
2550	100.417	100.458	100.500	100.542	100.583	100.625	100.667	100.708	100.750	100.792
2560	100.833	100.875	100.917	100.958	93.231	93.269	93.308	93.346	93.385	93.423
2570	93.462	93.500	93.538	93.577	93.615	93.654	93.692	93.731	93.769	93.808
2580	93.846	93.885	93.923	93.962	94.000	94.038	94.077	94.115	94.154	94.192
2590	94.231	94.269	94.308	94.346	94.385	94.423	94.462	94.500	94.538	94.577
2600	94.615	94.654	94.692	94.731	94.769	94.808	94.846	94.885	94.923	94.962
2610	95.000	95.038	95.077	95.115	95.154	95.192	95.231	95.269	95.308	95.346
2620	95.385	95.423	95.462	95.500	95.538	95.577	95.615	95.654	95.692	95.731
2630	95.769	95.808	95.846	95.885	95.923	95.962	96.000	96.038	96.077	96.115
2640	96.154	96.192	96.231	96.269	96.308	96.346	96.385	96.423	96.462	96.500
2650	96.538	96.577	96.615	96.654	96.692	96.731	96.769	96.808	96.846	96.885
2660	96.923	96.962	97.000	97.038	97.077	97.115	97.154	97.192	97.231	97.269
2670	97.308	97.346	97.385	97.423	97.462	97.500	97.538	97.577	97.615	97.654
2680	97.692	97.731	97.769	97.808	97.846	97.885	97.923	97.962	98.000	98.038
2690	98.077	98.115	98.154	98.192	98.231	98.269	98.308	98.346	98.385	98.423
2700	98.462	98.500	98.538	98.577	98.615	98.654	98.692	98.731	98.769	98.808

SYNTHESIZER FREQUENCIES, TCM-602

	0	1	2	3	4	5	6	7	8	9
3400	95.882	95.912	95.941	95.971	96.000	96.029	96.059	96.088	96.118	96.147
3410	96.176	96.206	96.235	96.265	96.294	96.324	96.353	96.382	96.412	96.441
3420	96.471	96.500	96.529	96.559	96.588	96.618	96.647	96.676	96.706	96.735
3430	96.765	96.794	96.824	96.853	96.882	96.912	96.941	96.971	97.000	97.029
3440	97.059	97.088	97.118	97.147	97.176	97.206	97.235	97.265	97.294	97.324
3450	97.353	97.382	97.412	97.441	97.471	97.500	97.529	97.559	97.588	97.618
3460	97.647	97.676	97.706	97.735	97.765	97.794	97.824	97.853	97.882	97.912
3470	97.941	97.971	98.000	98.029	98.059	98.088	98.118	98.147	98.176	98.206
3480	98.235	98.265	98.294	98.324	98.353	98.382	98.412	98.441	98.471	98.500
3490	98.529	98.559	98.588	98.618	98.647	98.676	98.706	98.735	98.765	98.794
3500	98.824	98.853	98.882	98.912	98.941	98.971	99.000	99.029	99.059	99.088
3510	99.118	99.147	99.176	99.206	99.235	99.265	99.294	99.324	99.353	99.382
3520	99.412	99.441	99.471	99.500	99.529	99.559	99.588	99.618	99.647	99.676
3530	99.706	99.735	99.765	99.794	99.824	99.853	99.882	99.912	99.941	99.971
3540	100.000	100.029	100.059	100.088	100.118	100.147	100.176	100.206	100.235	100.265
3550	100.294	100.324	100.353	100.382	100.412	100.441	100.471	100.500	100.529	100.559
3560	100.588	100.618	100.647	100.676	100.706	100.735	100.765	100.794	95.222	95.250
3570	95.278	95.306	95.333	95.361	95.389	95.417	95.444	95.472	95.500	95.528
3580	95.556	95.583	95.611	95.639	95.667	95.694	95.722	95.750	95.778	95.806
3590	95.833	95.861	95.889	95.917	95.944	95.972	96.000	96.028	96.056	96.083
3600	96.111	96.139	96.167	96.194	96.222	96.250	96.278	96.306	96.333	96.361
3610	96.389	96.417	96.444	96.472	96.500	96.528	96.556	96.583	96.611	96.639
3620	96.667	96.694	96.722	96.750	96.778	96.806	96.833	96.861	96.889	96.917
3630	96.944	96.972	97.000	97.028	97.056	97.083	97.111	97.139	97.167	97.194
3640	97.222	97.250	97.278	97.306	97.333	97.361	97.389	97.417	97.444	97.472
3650	97.500	97.528	97.556	97.583	97.611	97.639	97.667	97.694	97.722	97.750
3660	97.778	97.806	97.833	97.861	97.889	97.917	97.944	97.972	98.000	98.028
3670	98.056	98.083	98.111	98.139	98.167	98.194	98.222	98.250	98.278	98.306
3680	98.333	98.361	98.389	98.417	98.444	98.472	98.500	98.528	98.556	98.583
3690	98.611	98.639	98.667	98.694	98.722	98.750	98.778	98.806	98.833	98.861
3700	98.889	98.917	98.944	98.972	99.000	99.028	99.056	99.083	99.111	99.139
3710	99.167	99.194	99.222	99.250	99.278	99.306	99.333	99.361	99.389	99.417
3720	99.444	99.472	99.500	99.528	99.556	99.583	99.611	99.639	99.667	99.694
3730	99.722	99.750	99.778	99.806	99.833	99.861	99.889	99.917	99.944	99.972
3740	100.000	100.028	100.056	100.083	100.111	100.139	100.167	100.194	100.222	100.250
3750	100.278	100.306	100.333	100.361	100.389	100.417	100.444	100.472	100.500	100.528
3760	100.556	100.583	100.611	100.639	95.368	95.395	95.421	95.447	95.474	95.500
3770	95.526	95.553	95.579	95.605	95.632	95.658	95.684	95.711	95.737	95.763
3780	95.789	95.816	95.842	95.868	95.895	95.921	95.947	95.974	96.000	96.026
3790	96.053	96.079	96.105	96.132	96.158	96.184	96.211	96.237	96.263	96.289
3800	96.316	96.342	96.368	96.395	96.421	96.447	96.474	96.500	96.526	96.553
3810	96.579	96.605	96.632	96.658	96.684	96.711	96.737	96.763	96.789	96.816
3820	96.842	96.868	96.895	96.921	96.947	96.974	97.000	97.026	97.053	97.079
3830	97.105	97.132	97.158	97.184	97.211	97.237	97.263	97.289	97.316	97.342
3840	97.368	97.395	97.421	97.447	97.474	97.500	97.526	97.553	97.579	97.605
3850	97.632	97.658	97.684	97.711	97.737	97.763	97.789	97.816	97.842	97.868
3860	97.895	97.921	97.947	97.974	98.000	98.026	98.053	98.079	98.105	98.132
3870	98.158	98.184	98.211	98.237	98.263	98.289	98.316	98.342	98.368	98.395
3880	98.421	98.447	98.474	98.500	98.526	98.553	98.579	98.605	98.632	98.658
3890	98.684	98.711	98.737	98.763	98.789	98.816	98.842	98.868	98.895	98.921

SYNTHESIZER FREQUENCIES, TCM-602

	0	1	2	3	4	5	6	7	8	9
3900	98.947	98.974	99.000	99.026	99.053	99.079	99.105	99.132	99.158	99.184
3910	99.211	99.237	99.263	99.289	99.316	99.342	99.368	99.395	99.421	99.447
3920	99.474	99.500	99.526	99.553	99.579	99.605	99.632	99.658	99.684	99.711
3930	99.737	99.763	99.789	99.816	99.842	99.868	99.895	99.921	99.947	99.974
3940	100.000	100.026	100.053	100.079	100.105	100.132	100.158	100.184	100.211	100.237
3950	100.263	100.289	100.316	100.342	100.368	100.395	100.421	100.447	100.474	100.500
3960	95.500	95.525	95.550	95.575	95.600	95.625	95.650	95.675	95.700	95.725
3970	95.750	95.775	95.800	95.825	95.850	95.875	95.900	95.925	95.950	95.975
3980	96.000	96.025	96.050	96.075	96.100	96.125	96.150	96.175	96.200	96.225
3990	96.250	96.275	96.300	96.325	96.350	96.375	96.400	96.425	96.450	96.475
4000	96.500	96.525	96.550	96.575	96.600	96.625	96.650	96.675	96.700	96.725
4010	96.750	96.775	96.800	96.825	96.850	96.875	96.900	96.925	96.950	96.975
4020	97.000	97.025	97.050	97.075	97.100	97.125	97.150	97.175	97.200	97.225
4030	97.250	97.275	97.300	97.325	97.350	97.375	97.400	97.425	97.450	97.475
4040	97.500	97.525	97.550	97.575	97.600	97.625	97.650	97.675	97.700	97.725
4050	97.750	97.775	97.800	97.825	97.850	97.875	97.900	97.925	97.950	97.975
4060	98.000	98.025	98.050	98.075	98.100	98.125	98.150	98.175	98.200	98.225
4070	98.250	98.275	98.300	98.325	98.350	98.375	98.400	98.425	98.450	98.475
4080	98.500	98.525	98.550	98.575	98.600	98.625	98.650	98.675	98.700	98.725
4090	98.750	98.775	98.800	98.825	98.850	98.875	98.900	98.925	98.950	98.975
4100	99.000	99.025	99.050	99.075	99.100	99.125	99.150	99.175	99.200	99.225
4110	99.250	99.275	99.300	99.325	99.350	99.375	99.400	99.425	99.450	99.475
4120	99.500	99.525	99.550	99.575	99.600	99.625	99.650	99.675	99.700	99.725
4130	99.750	99.775	99.800	99.825	99.850	99.875	99.900	99.925	99.950	99.975
4140	100.000	100.025	100.050	100.075	100.100	100.125	100.150	100.175	100.200	100.225
4150	100.250	100.275	100.300	100.325	100.350	100.375	95.619	95.643	95.667	95.690
4160	95.714	95.738	95.762	95.786	95.810	95.833	95.857	95.881	95.905	95.929
4170	95.952	95.976	96.000	96.024	96.048	96.071	96.095	96.119	96.143	96.167
4180	96.190	96.214	96.238	96.262	96.286	96.310	96.333	96.357	96.381	96.405
4190	96.429	96.452	96.476	96.500	96.524	96.548	96.571	96.595	96.619	96.643
4200	96.667	96.690	96.714	96.738	96.762	96.786	96.810	96.833	96.857	96.881
4210	96.905	96.929	96.952	96.976	97.000	97.024	97.048	97.071	97.095	97.119
4220	97.143	97.167	97.190	97.214	97.238	97.262	97.286	97.310	97.333	97.357
4230	97.381	97.405	97.429	97.452	97.476	97.500	97.524	97.548	97.571	97.595
4240	97.619	97.643	97.667	97.690	97.714	97.738	97.762	97.786	97.810	97.833
4250	97.857	97.881	97.905	97.929	97.952	97.976	98.000	98.024	98.048	98.071
4260	98.095	98.119	98.143	98.167	98.190	98.214	98.238	98.262	98.286	98.310
4270	98.333	98.357	98.381	98.405	98.429	98.452	98.476	98.500	98.524	98.548
4280	98.571	98.595	98.619	98.643	98.667	98.690	98.714	98.738	98.762	98.786
4290	98.810	98.833	98.857	98.881	98.905	98.929	98.952	98.976	99.000	99.024
4300	99.048	99.071	99.095	99.119	99.143	99.167	99.190	99.214	99.238	99.262
4310	99.286	99.310	99.333	99.357	99.381	99.405	99.429	99.452	99.476	99.500
4320	99.524	99.548	99.571	99.595	99.619	99.643	99.667	99.690	99.714	99.738
4330	99.762	99.786	99.810	99.833	99.857	99.881	99.905	99.929	99.952	99.976
4340	100.000	100.024	100.048	100.071	100.095	100.119	100.143	100.167	100.190	100.214
4350	100.238	100.262	95.727	95.750	95.773	95.795	95.818	95.841	95.864	95.886
4360	95.909	95.932	95.955	95.977	96.000	96.023	96.045	96.068	96.091	96.114
4370	96.136	96.159	96.182	96.205	96.227	96.250	96.273	96.295	96.318	96.341
4380	96.364	96.386	96.409	96.432	96.455	96.477	96.500	96.523	96.545	96.568
4390	96.591	96.614	96.636	96.659	96.682	96.705	96.727	96.750	96.773	96.795

SYNTHESIZER FREQUENCIES, TCM-602

	0	1	2	3	4	5	6	7	8	9
4400	96.818	96.841	96.864	96.886	96.909	96.932	96.955	96.977	97.000	97.023
4410	97.045	97.068	97.091	97.114	97.136	97.159	97.182	97.205	97.227	97.250
4420	97.273	97.295	97.318	97.341	97.364	97.386	97.409	97.432	97.455	97.477
4430	97.500	97.523	97.545	97.568	97.591	97.614	97.636	97.659	97.682	97.705
4440	97.727	97.750	97.773	97.795	97.818	97.841	97.864	97.886	97.909	97.932
4450	97.955	97.977	98.000	98.023	98.045	98.068	98.091	98.114	98.136	98.159
4460	98.182	98.205	98.227	98.250	98.273	98.295	98.318	98.341	98.364	98.386
4470	98.409	98.432	98.455	98.477	98.500	98.523	98.545	98.568	98.591	98.614
4480	98.636	98.659	98.682	98.705	98.727	98.750	98.773	98.795	98.818	98.841
4490	98.864	98.886	98.909	98.932	98.955	98.977	99.000	99.023	99.045	99.068
4500	99.091	99.114	99.136	99.159	99.182	99.205	99.227	99.250	99.273	99.295
4510	99.318	99.341	99.364	99.386	99.409	99.432	99.455	99.477	99.500	99.523
4520	99.545	99.568	99.591	99.614	99.636	99.659	99.682	99.705	99.727	99.750
4530	99.773	99.795	99.818	99.841	99.864	99.886	99.909	99.932	99.955	99.977
4540	100.000	100.023	100.045	100.068	100.091	100.114	100.136	100.159	95.826	95.848
4550	95.870	95.891	95.913	95.935	95.957	95.978	96.000	96.022	96.043	96.065
4560	96.087	96.109	96.130	96.152	96.174	96.196	96.217	96.239	96.261	96.283
4570	96.304	96.326	96.348	96.370	96.391	96.413	96.435	96.457	96.478	96.500
4580	96.522	96.543	96.565	96.587	96.609	96.630	96.652	96.674	96.696	96.717
4590	96.739	96.761	96.783	96.804	96.826	96.848	96.870	96.891	96.913	96.935
4600	96.957	96.978	97.000	97.022	97.043	97.065	97.087	97.109	97.130	97.152
4610	97.174	97.196	97.217	97.239	97.261	97.283	97.304	97.326	97.348	97.370
4620	97.391	97.413	97.435	97.457	97.478	97.500	97.522	97.543	97.565	97.587
4630	97.609	97.630	97.652	97.674	97.696	97.717	97.739	97.761	97.783	97.804
4640	97.826	97.848	97.870	97.891	97.913	97.935	97.957	97.978	98.000	98.022
4650	98.043	98.065	98.087	98.109	98.130	98.152	98.174	98.196	98.217	98.239
4660	98.261	98.283	98.304	98.326	98.348	98.370	98.391	98.413	98.435	98.457
4670	98.478	98.500	98.522	98.543	98.565	98.587	98.609	98.630	98.652	98.674
4680	98.696	98.717	98.739	98.761	98.783	98.804	98.826	98.848	98.870	98.891
4690	98.913	98.935	98.957	98.978	99.000	99.022	99.043	99.065	99.087	99.109
4700	99.130	99.152	99.174	99.196	99.217	99.239	99.261	99.283	99.304	99.326
4710	99.348	99.370	99.391	99.413	99.435	99.457	99.478	99.500	99.522	99.543
4720	99.565	99.587	99.609	99.630	99.652	99.674	99.696	99.717	99.739	99.761
4730	99.783	99.804	99.826	99.848	99.870	99.891	99.913	99.935	99.957	99.978
4740	100.000	100.022	100.043	100.065	95.917	95.938	95.958	95.979	96.000	96.021
4750	96.042	96.063	96.083	96.104	96.125	96.146	96.167	96.188	96.208	96.229
4760	96.250	96.271	96.292	96.313	96.333	96.354	96.375	96.396	96.417	96.438
4770	96.458	96.479	96.500	96.521	96.542	96.563	96.583	96.604	96.625	96.646
4780	96.667	96.688	96.708	96.729	96.750	96.771	96.792	96.813	96.833	96.854
4790	96.875	96.896	96.917	96.938	96.958	96.979	97.000	97.021	97.042	97.063
4800	97.083	97.104	97.125	97.146	97.167	97.188	97.208	97.229	97.250	97.271
4810	97.292	97.313	97.333	97.354	97.375	97.396	97.417	97.438	97.458	97.479
4820	97.500	97.521	97.542	97.563	97.583	97.604	97.625	97.646	97.667	97.688
4830	97.708	97.729	97.750	97.771	97.792	97.813	97.833	97.854	97.875	97.896
4840	97.917	97.938	97.958	97.979	98.000	98.021	98.042	98.063	98.083	98.104
4850	98.125	98.146	98.167	98.188	98.208	98.229	98.250	98.271	98.292	98.313
4860	98.333	98.354	98.375	98.396	98.417	98.438	98.458	98.479	98.500	98.521
4870	98.542	98.563	98.583	98.604	98.625	98.646	98.667	98.688	98.708	98.729
4880	98.750	98.771	98.792	98.813	98.833	98.854	98.875	98.896	98.917	98.938
4890	98.958	98.979	99.000	99.021	99.042	99.063	99.083	99.104	99.125	99.146

SYNTHESIZER FREQUENCIES, TCM-602

	0	1	2	3	4	5	6	7	8	9
4900	99.167	99.188	99.208	99.229	99.250	99.271	99.292	99.313	99.333	99.354
4910	99.375	99.396	99.417	99.438	99.458	99.479	99.500	99.521	99.542	99.563
4920	99.583	99.604	99.625	99.646	99.667	99.688	99.708	99.729	99.750	99.771
4930	99.792	99.813	99.833	99.854	99.875	99.896	99.917	99.938	99.958	99.979
4940	96.000	96.020	96.040	96.060	96.080	96.100	96.120	96.140	96.160	96.180
4950	96.200	96.220	96.240	96.260	96.280	96.300	96.320	96.340	96.360	96.380
4960	96.400	96.420	96.440	96.460	96.480	96.500	96.520	96.540	96.560	96.580
4970	96.600	96.620	96.640	96.660	96.680	96.700	96.720	96.740	96.760	96.780
4980	96.800	96.820	96.840	96.860	96.880	96.900	96.920	96.940	96.960	96.980
4990	97.000	97.020	97.040	97.060	97.080	97.100	97.120	97.140	97.160	97.180
5000	97.200	97.220	97.240	97.260	97.280	97.300	97.320	97.340	97.360	97.380

	0	1	2	3	4	5	6	7	8	9
5920	100.175	100.193	100.211	100.228	100.246	100.263	100.281	100.298	100.316	100.333
5930	100.351	100.368	100.386	100.404	100.421	100.439	100.456	100.474	100.491	100.509
5940	95.500	95.517	95.533	95.550	95.567	95.583	95.600	95.617	95.633	95.650
5950	95.667	95.683	95.700	95.717	95.733	95.750	95.767	95.783	95.800	95.817
5960	95.833	95.850	95.867	95.883	95.900	95.917	95.933	95.950	95.967	95.983
5970	96.000	96.017	96.033	96.050	96.067	96.083	96.100	96.117	96.133	96.150
5980	96.167	96.183	96.200	96.217	96.233	96.250	96.267	96.283	96.300	96.317
5990	96.333	96.350	96.367	96.383	96.400	96.417	96.433	96.450	96.467	96.483
6000	96.500	96.517	96.533	96.550	96.567	96.583	96.600	96.617	96.633	96.650
6010	96.667	96.683	96.700	96.717	96.733	96.750	96.767	96.783	96.800	96.817
6020	96.833	96.850	96.867	96.883	96.900	96.917	96.933	96.950	96.967	96.983
6030	97.000	97.017	97.033	97.050	97.067	97.083	97.100	97.117	97.133	97.150
6040	97.167	97.183	97.200	97.217	97.233	97.250	97.267	97.283	97.300	97.317
6050	97.333	97.350	97.367	97.383	97.400	97.417	97.433	97.450	97.467	97.483
6060	97.500	97.517	97.533	97.550	97.567	97.583	97.600	97.617	97.633	97.650
6070	97.667	97.683	97.700	97.717	97.733	97.750	97.767	97.783	97.800	97.817
6080	97.833	97.850	97.867	97.883	97.900	97.917	97.933	97.950	97.967	97.983
6090	98.000	98.017	98.033	98.050	98.067	98.083	98.100	98.117	98.133	98.150
6100	98.167	98.183	98.200	98.217	98.233	98.250	98.267	98.283	98.300	98.317
6110	98.333	98.350	98.367	98.383	98.400	98.417	98.433	98.450	98.467	98.483
6120	98.500	98.517	98.533	98.550	98.567	98.583	98.600	98.617	98.633	98.650
6130	98.667	98.683	98.700	98.717	98.733	98.750	98.767	98.783	98.800	98.817
6140	98.833	98.850	98.867	98.883	98.900	98.917	98.933	98.950	98.967	98.983
6150	99.000	99.017	99.033	99.050	99.067	99.083	99.100	99.117	99.133	99.150
6160	99.167	99.183	99.200	99.217	99.233	99.250	99.267	99.283	99.300	99.317
6170	99.333	99.350	99.367	99.383	99.400	99.417	99.433	99.450	99.467	99.483
6180	99.500	99.517	99.533	99.550	99.567	99.583	99.600	99.617	99.633	99.650
6190	99.667	99.683	99.700	99.717	99.733	99.750	99.767	99.783	99.800	99.817
6200	99.833	99.850	99.867	99.883	99.900	99.917	99.933	99.950	99.967	99.983
6210	100.000	100.017	100.033	100.050	100.067	100.083	100.100	100.117	100.133	100.150
6220	100.167	100.183	100.200	100.217	100.233	100.250	100.267	100.283	100.300	100.317
6230	100.333	100.350	100.367	100.383	95.619	95.635	95.651	95.667	95.683	95.698
6240	95.714	95.730	95.746	95.762	95.778	95.794	95.810	95.825	95.841	95.857
6250	95.873	95.889	95.905	95.921	95.937	95.952	95.968	95.984	96.000	96.016
6260	96.032	96.048	96.064	96.079	96.095	96.111	96.127	96.143	96.159	96.175
6270	96.190	96.206	96.222	96.238	96.254	96.270	96.286	96.302	96.317	96.333
6280	96.349	96.365	96.381	96.397	96.413	96.429	96.444	96.460	96.476	96.492
6290	96.508	96.524	96.540	96.556	96.571	96.587	96.603	96.619	96.635	96.651
6300	96.667	96.683	96.698	96.714	96.730	96.746	96.762	96.778	96.794	96.810
6310	96.825	96.841	96.857	96.873	96.889	96.905	96.921	96.937	96.952	96.968
6320	96.984	97.000	97.016	97.032	97.048	97.064	97.079	97.095	97.111	97.127
6330	97.143	97.159	97.175	97.190	97.206	97.222	97.238	97.254	97.270	97.286
6340	97.302	97.317	97.333	97.349	97.365	97.381	97.397	97.413	97.429	97.444
6350	97.460	97.476	97.492	97.508	97.524	97.540	97.556	97.571	97.587	97.603
6360	97.619	97.635	97.651	97.667	97.683	97.698	97.714	97.730	97.746	97.762
6370	97.778	97.794	97.810	97.825	97.841	97.857	97.873	97.889	97.905	97.921
6380	97.937	97.952	97.968	97.984	98.000	98.016	98.032	98.048	98.064	98.079
6390	98.095	98.111	98.127	98.143	98.159	98.175	98.190	98.206	98.222	98.238
6400	98.254	98.270	98.286	98.302	98.317	98.333	98.349	98.365	98.381	98.397
6410	98.413	98.429	98.444	98.460	98.476	98.492	98.508	98.524	98.540	98.556

SYNTHESIZER FREQUENCIES, TCM-603

	0	1	2	3	4	5	6	7	8	9
6420	98.571	98.587	98.603	98.619	98.635	98.651	98.667	98.683	98.698	98.714
6430	98.730	98.746	98.762	98.778	98.794	98.810	98.825	98.841	98.857	98.873
6440	98.889	98.905	98.921	98.937	98.952	98.968	98.984	99.000	99.016	99.032
6450	99.048	99.064	99.079	99.095	99.111	99.127	99.143	99.159	99.175	99.190
6460	99.206	99.222	99.238	99.254	99.270	99.286	99.302	99.317	99.333	99.349
6470	99.365	99.381	99.397	99.413	99.429	99.444	99.460	99.476	99.492	99.508
6480	99.524	99.540	99.556	99.571	99.587	99.603	99.619	99.635	99.651	99.667
6490	99.683	99.698	99.714	99.730	99.746	99.762	99.778	99.794	99.810	99.825
6500	99.841	99.857	99.873	99.889	99.905	99.921	99.937	99.952	99.968	99.984
6510	100.000	100.016	100.032	100.048	100.064	100.079	100.095	100.111	100.127	100.143
6520	100.159	100.175	100.190	100.206	100.222	100.238	100.254	100.270	95.727	95.742
6530	95.758	95.773	95.788	95.803	95.818	95.833	95.848	95.864	95.879	95.894
6540	95.909	95.924	95.939	95.955	95.970	95.985	96.000	96.015	96.030	96.045
6550	96.061	96.076	96.091	96.106	96.121	96.136	96.152	96.167	96.182	96.197
6560	96.212	96.227	96.242	96.258	96.273	96.288	96.303	96.318	96.333	96.348
6570	96.364	96.379	96.394	96.409	96.424	96.439	96.455	96.470	96.485	96.500
6580	96.515	96.530	96.545	96.561	96.576	96.591	96.606	96.621	96.636	96.652
6590	96.667	96.682	96.697	96.712	96.727	96.742	96.758	96.773	96.788	96.803
6600	96.818	96.833	96.848	96.864	96.879	96.894	96.909	96.924	96.939	96.955
6610	96.970	96.985	97.000	97.015	97.030	97.045	97.061	97.076	97.091	97.106
6620	97.121	97.136	97.152	97.167	97.182	97.197	97.212	97.227	97.242	97.258
6630	97.273	97.288	97.303	97.318	97.333	97.348	97.364	97.379	97.394	97.409
6640	97.424	97.439	97.455	97.470	97.485	97.500	97.515	97.530	97.545	97.561
6650	97.576	97.591	97.606	97.621	97.636	97.652	97.667	97.682	97.697	97.712
6660	97.727	97.742	97.758	97.773	97.788	97.803	97.818	97.833	97.848	97.864
6670	97.879	97.894	97.909	97.924	97.939	97.955	97.970	97.985	98.000	98.015
6680	98.030	98.045	98.061	98.076	98.091	98.106	98.121	98.136	98.152	98.167
6690	98.182	98.197	98.212	98.227	98.242	98.258	98.273	98.288	98.303	98.318
6700	98.333	98.348	98.364	98.379	98.394	98.409	98.424	98.439	98.455	98.470
6710	98.485	98.500	98.515	98.530	98.545	98.561	98.576	98.591	98.606	98.621
6720	98.636	98.652	98.667	98.682	98.697	98.712	98.727	98.742	98.758	98.773
6730	98.788	98.803	98.818	98.833	98.848	98.864	98.879	98.894	98.909	98.924
6740	98.939	98.955	98.970	98.985	99.000	99.015	99.030	99.045	99.061	99.076
6750	99.091	99.106	99.121	99.136	99.152	99.167	99.182	99.197	99.212	99.227
6760	99.242	99.258	99.273	99.288	99.303	99.318	99.333	99.348	99.364	99.379
6770	99.394	99.409	99.424	99.439	99.455	99.470	99.485	99.500	99.515	99.530
6780	99.545	99.561	99.576	99.591	99.606	99.621	99.636	99.652	99.667	99.682
6790	99.697	99.712	99.727	99.742	99.758	99.773	99.788	99.803	99.818	99.833
6800	99.848	99.864	99.879	99.894	99.909	99.924	99.939	99.955	99.970	99.985
6810	100.000	100.015	100.030	100.045	100.061	100.076	100.091	100.106	100.121	100.136
6820	100.152	100.167	95.826	95.841	95.855	95.870	95.884	95.899	95.913	95.928
6830	95.942	95.957	95.971	95.986	96.000	96.014	96.029	96.043	96.058	96.072
6840	96.087	96.101	96.116	96.130	96.145	96.159	96.174	96.188	96.203	96.217
6850	96.232	96.246	96.261	96.275	96.290	96.304	96.319	96.333	96.348	96.362
6860	96.377	96.391	96.406	96.420	96.435	96.449	96.464	96.478	96.493	96.507
6870	96.522	96.536	96.551	96.565	96.580	96.594	96.609	96.623	96.638	96.652
6880	96.667	96.681	96.696	96.710	96.725	96.739	96.754	96.768	96.783	96.797
6890	96.812	96.826	96.841	96.855	96.870	96.884	96.899	96.913	96.928	96.942
6900	96.957	96.971	96.986	97.000	97.014	97.029	97.043	97.058	97.072	97.087
6910	97.101	97.116	97.130	97.145	97.159	97.174	97.188	97.203	97.217	97.232

	0	1	2	3	4	5	6	7	8	9
6920	97.246	97.261	97.275	97.290	97.304	97.319	97.333	97.348	97.362	97.377
6930	97.391	97.406	97.420	97.435	97.449	97.464	97.478	97.493	97.507	97.522
6940	97.536	97.551	97.565	97.580	97.594	97.609	97.623	97.638	97.652	97.667
6950	97.681	97.696	97.710	97.725	97.739	97.754	97.768	97.783	97.797	97.812
6960	97.826	97.841	97.855	97.870	97.884	97.899	97.913	97.928	97.942	97.957
6970	97.971	97.986	98.000	98.014	98.029	98.043	98.058	98.072	98.087	98.101
6980	98.116	98.130	98.145	98.159	98.174	98.188	98.203	98.217	98.232	98.246
6990	98.261	98.275	98.290	98.304	98.319	98.333	98.348	98.362	98.377	98.391
7000	98.406	98.420	98.435	98.449	98.464	98.478	98.493	98.507	98.522	98.536
7010	98.551	98.565	98.580	98.594	98.609	98.623	98.638	98.652	98.667	98.681
7020	98.696	98.710	98.725	98.739	98.754	98.768	98.783	98.797	98.812	98.826
7030	98.841	98.855	98.870	98.884	98.899	98.913	98.928	98.942	98.957	98.971
7040	98.986	99.000	99.014	99.029	99.043	99.058	99.072	99.087	99.101	99.116
7050	99.130	99.145	99.159	99.174	99.188	99.203	99.217	99.232	99.246	99.261
7060	99.275	99.290	99.304	99.319	99.333	99.348	99.362	99.377	99.391	99.406
7070	99.420	99.435	99.449	99.464	99.478	99.493	99.507	99.522	99.536	99.551
7080	99.565	99.580	99.594	99.609	99.623	99.638	99.652	99.667	99.681	99.696
7090	99.710	99.725	99.739	99.754	99.768	99.783	99.797	99.812	99.826	99.841
7100	99.855	99.870	99.884	99.899	99.913	99.928	99.942	99.957	99.971	99.986
7110	100.000	100.014	100.029	100.043	100.058	100.072	95.917	95.931	95.944	95.958
7120	95.972	95.986	96.000	96.014	96.028	96.042	96.056	96.069	96.083	96.097
7130	96.111	96.125	96.139	96.153	96.167	96.181	96.194	96.208	96.222	96.236
7140	96.250	96.264	96.278	96.292	96.306	96.319	96.333	96.347	96.361	96.375
7150	96.389	96.403	96.417	96.431	96.444	96.458	96.472	96.486	96.500	96.514
7160	96.528	96.542	96.556	96.569	96.583	96.597	96.611	96.625	96.639	96.653
7170	96.667	96.681	96.694	96.708	96.722	96.736	96.750	96.764	96.778	96.792
7180	96.806	96.819	96.833	96.847	96.861	96.875	96.889	96.903	96.917	96.931
7190	96.944	96.958	96.972	96.986	97.000	97.014	97.028	97.042	97.056	97.069
7200	97.083	97.097	97.111	97.125	97.139	97.153	97.167	97.181	97.194	97.208

SYNTHESIZER FREQUENCIES, TCM-604

	0	1	2	3	4	5	6	7	8	9
7120	100.588	100.603	100.618	100.632	100.647	100.662	100.676	100.691	100.706	100.721
7130	100.735	100.750	100.765	100.779	100.794	95.208	95.222	95.236	95.250	95.264
7140	95.278	95.292	95.306	95.319	95.333	95.347	95.361	95.375	95.389	95.403
7150	95.417	95.431	95.444	95.458	95.472	95.486	95.500	95.514	95.528	95.542
7160	95.556	95.569	95.583	95.597	95.611	95.625	95.639	95.653	95.667	95.681
7170	95.694	95.708	95.722	95.736	95.750	95.764	95.778	95.792	95.806	95.819
7180	95.833	95.847	95.861	95.875	95.889	95.903	95.917	95.931	95.944	95.958
7190	95.972	95.986	96.000	96.014	96.028	96.042	96.056	96.069	96.083	96.097
7200	96.111	96.125	96.139	96.153	96.167	96.181	96.194	96.208	96.222	96.236
7210	96.250	96.264	96.278	96.292	96.306	96.319	96.333	96.347	96.361	96.375
7220	96.389	96.403	96.417	96.431	96.444	96.458	96.472	96.486	96.500	96.514
7230	96.528	96.542	96.556	96.569	96.583	96.597	96.611	96.625	96.639	96.653
7240	96.667	96.681	96.694	96.708	96.722	96.736	96.750	96.764	96.778	96.792
7250	96.806	96.819	96.833	96.847	96.861	96.875	96.889	96.903	96.917	96.931
7260	96.944	96.958	96.972	96.986	97.000	97.014	97.028	97.042	97.056	97.069
7270	97.083	97.097	97.111	97.125	97.139	97.153	97.167	97.181	97.194	97.208
7280	97.222	97.236	97.250	97.264	97.278	97.292	97.306	97.319	97.333	97.347
7290	97.361	97.375	97.389	97.403	97.417	97.431	97.444	97.458	97.472	97.486
7300	97.500	97.514	97.528	97.542	97.556	97.569	97.583	97.597	97.611	97.625
7310	97.639	97.653	97.667	97.681	97.694	97.708	97.722	97.736	97.750	97.764
7320	97.778	97.792	97.806	97.819	97.833	97.847	97.861	97.875	97.889	97.903
7330	97.917	97.931	97.944	97.958	97.972	97.986	98.000	98.014	98.028	98.042
7340	98.056	98.069	98.083	98.097	98.111	98.125	98.139	98.153	98.167	98.181
7350	98.194	98.208	98.222	98.236	98.250	98.264	98.278	98.292	98.306	98.319
7360	98.333	98.347	98.361	98.375	98.389	98.403	98.417	98.431	98.444	98.458
7370	98.472	98.486	98.500	98.514	98.528	98.542	98.556	98.569	98.583	98.597
7380	98.611	98.625	98.639	98.653	98.667	98.681	98.694	98.708	98.722	98.736
7390	98.750	98.764	98.778	98.792	98.806	98.819	98.833	98.847	98.861	98.875
7400	98.889	98.903	98.917	98.931	98.944	98.958	98.972	98.986	99.000	99.014
7410	99.028	99.042	99.056	99.069	99.083	99.097	99.111	99.125	99.139	99.153
7420	99.167	99.181	99.194	99.208	99.222	99.236	99.250	99.264	99.278	99.292
7430	99.306	99.319	99.333	99.347	99.361	99.375	99.389	99.403	99.417	99.431
7440	99.444	99.458	99.472	99.486	99.500	99.514	99.528	99.542	99.556	99.569
7450	99.583	99.597	99.611	99.625	99.639	99.653	99.667	99.681	99.694	99.708
7460	99.722	99.736	99.750	99.764	99.778	99.792	99.806	99.819	99.833	99.847
7470	99.861	99.875	99.889	99.903	99.917	99.931	99.944	99.958	99.972	99.986
7480	100.000	100.014	100.028	100.042	100.056	100.069	100.083	100.097	100.111	100.125
7490	100.139	100.153	100.167	100.181	100.194	100.208	100.222	100.236	100.250	100.264
7500	100.278	100.292	100.306	100.319	100.333	100.347	100.361	100.375	100.389	100.403
7510	100.417	100.431	100.444	100.458	100.472	100.486	100.500	100.514	100.528	100.542
7520	100.556	100.569	100.583	100.597	100.611	100.625	100.639	95.355	95.368	95.382
7530	95.395	95.408	95.421	95.434	95.447	95.461	95.474	95.487	95.500	95.513
7540	95.526	95.539	95.553	95.566	95.579	95.592	95.605	95.618	95.632	95.645
7550	95.658	95.671	95.684	95.697	95.711	95.724	95.737	95.750	95.763	95.776
7560	95.789	95.803	95.816	95.829	95.842	95.855	95.868	95.882	95.895	95.908
7570	95.921	95.934	95.947	95.961	95.974	95.987	96.000	96.013	96.026	96.039
7580	96.053	96.066	96.079	96.092	96.105	96.118	96.132	96.145	96.158	96.171
7590	96.184	96.197	96.211	96.224	96.237	96.250	96.263	96.276	96.289	96.303
7600	96.316	96.329	96.342	96.355	96.368	96.382	96.395	96.408	96.421	96.434
7610	96.447	96.461	96.474	96.487	96.500	96.513	96.526	96.539	96.553	96.566

SYNTHESIZER FREQUENCIES, TCM-604

	0	1	2	3	4	5	6	7	8	9
7620	96.579	96.592	96.605	96.618	96.632	96.645	96.658	96.671	96.684	96.697
7630	96.711	96.724	96.737	96.750	96.763	96.776	96.789	96.803	96.816	96.829
7640	96.842	96.855	96.868	96.882	96.895	96.908	96.921	96.934	96.947	96.961
7650	96.974	96.987	97.000	97.013	97.026	97.039	97.053	97.066	97.079	97.092
7660	97.105	97.118	97.132	97.145	97.158	97.171	97.184	97.197	97.211	97.224
7670	97.237	97.250	97.263	97.276	97.289	97.303	97.316	97.329	97.342	97.355
7680	97.368	97.382	97.395	97.408	97.421	97.434	97.447	97.461	97.474	97.487
7690	97.500	97.513	97.526	97.539	97.553	97.566	97.579	97.592	97.605	97.618
7700	97.632	97.645	97.658	97.671	97.684	97.697	97.711	97.724	97.737	97.750
7710	97.763	97.776	97.789	97.803	97.816	97.829	97.842	97.855	97.868	97.882
7720	97.895	97.908	97.921	97.934	97.947	97.961	97.974	97.987	98.000	98.013
7730	98.026	98.039	98.053	98.066	98.079	98.092	98.105	98.118	98.132	98.145
7740	98.158	98.171	98.184	98.197	98.211	98.224	98.237	98.250	98.263	98.276
7750	98.289	98.303	98.316	98.329	98.342	98.355	98.368	98.382	98.395	98.408
7760	98.421	98.434	98.447	98.461	98.474	98.487	98.500	98.513	98.526	98.539
7770	98.553	98.566	98.579	98.592	98.605	98.618	98.632	98.645	98.658	98.671
7780	98.684	98.697	98.711	98.724	98.737	98.750	98.763	98.776	98.789	98.803
7790	98.816	98.829	98.842	98.855	98.868	98.882	98.895	98.908	98.921	98.934
7800	98.947	98.961	98.974	98.987	99.000	99.013	99.026	99.039	99.053	99.066
7810	99.079	99.092	99.105	99.118	99.132	99.145	99.158	99.171	99.184	99.197
7820	99.211	99.224	99.237	99.250	99.263	99.276	99.289	99.303	99.316	99.329
7830	99.342	99.355	99.368	99.382	99.395	99.408	99.421	99.434	99.447	99.461
7840	99.474	99.487	99.500	99.513	99.526	99.539	99.553	99.566	99.579	99.592
7850	99.605	99.618	99.632	99.645	99.658	99.671	99.684	99.697	99.711	99.724
7860	99.737	99.750	99.763	99.776	99.789	99.803	99.816	99.829	99.842	99.855
7870	99.868	99.882	99.895	99.908	99.921	99.934	99.947	99.961	99.974	99.987
7880	100.000	100.013	100.026	100.039	100.053	100.066	100.079	100.092	100.105	100.118
7890	100.132	100.145	100.158	100.171	100.184	100.197	100.211	100.224	100.237	100.250
7900	100.263	100.276	100.289	100.303	100.316	100.329	100.342	100.355	100.368	100.382
7910	100.395	100.408	100.421	100.434	100.447	100.461	100.474	100.487	100.500	95.488
7920	95.500	95.513	95.525	95.538	95.550	95.563	95.575	95.588	95.600	95.613
7930	95.625	95.638	95.650	95.663	95.675	95.688	95.700	95.713	95.725	95.738
7940	95.750	95.763	95.775	95.788	95.800	95.813	95.825	95.838	95.850	95.863
7950	95.875	95.888	95.900	95.913	95.925	95.938	95.950	95.963	95.975	95.988
7960	96.000	96.013	96.025	96.038	96.050	96.063	96.075	96.088	96.100	96.113
7970	96.125	96.138	96.150	96.163	96.175	96.188	96.200	96.213	96.225	96.238
7980	96.250	96.263	96.275	96.288	96.300	96.313	96.325	96.338	96.350	96.363
7990	96.375	96.388	96.400	96.413	96.425	96.438	96.450	96.463	96.475	96.488
8000	96.500	96.513	96.525	96.538	96.550	96.563	96.575	96.588	96.600	96.613
8010	96.625	96.638	96.650	96.663	96.675	96.688	96.700	96.713	96.725	96.738
8020	96.750	96.763	96.775	96.788	96.800	96.813	96.825	96.838	96.850	96.863
8030	96.875	96.888	96.900	96.913	96.925	96.938	96.950	96.963	96.975	96.988
8040	97.000	97.013	97.025	97.038	97.050	97.063	97.075	97.088	97.100	97.113
8050	97.125	97.138	97.150	97.163	97.175	97.188	97.200	97.213	97.225	97.238
8060	97.250	97.263	97.275	97.288	97.300	97.313	97.325	97.338	97.350	97.363
8070	97.375	97.388	97.400	97.413	97.425	97.438	97.450	97.463	97.475	97.488
8080	97.500	97.513	97.525	97.538	97.550	97.563	97.575	97.588	97.600	97.613
8090	97.625	97.638	97.650	97.663	97.675	97.688	97.700	97.713	97.725	97.738
8100	97.750	97.763	97.775	97.788	97.800	97.813	97.825	97.838	97.850	97.863
8110	97.875	97.888	97.900	97.913	97.925	97.938	97.950	97.963	97.975	97.988

SYNTHESIZER FREQUENCIES, TCM-604

	0	1	2	3	4	5	6	7	8	9
8120	98.000	98.013	98.025	98.038	98.050	98.063	98.075	98.088	98.100	98.113
8130	98.125	98.138	98.150	98.163	98.175	98.188	98.200	98.213	98.225	98.238
8140	98.250	98.263	98.275	98.288	98.300	98.313	98.325	98.338	98.350	98.363
8150	98.375	98.388	98.400	98.413	98.425	98.438	98.450	98.463	98.475	98.488
8160	98.500	98.513	98.525	98.538	98.550	98.563	98.575	98.588	98.600	98.613
8170	98.625	98.638	98.650	98.663	98.675	98.688	98.700	98.713	98.725	98.738
8180	98.750	98.763	98.775	98.788	98.800	98.813	98.825	98.838	98.850	98.863
8190	98.875	98.888	98.900	98.913	98.925	98.938	98.950	98.963	98.975	98.988
8200	99.000	99.013	99.025	99.038	99.050	99.063	99.075	99.088	99.100	99.113
8210	99.125	99.138	99.150	99.163	99.175	99.188	99.200	99.213	99.225	99.238
8220	99.250	99.263	99.275	99.288	99.300	99.313	99.325	99.338	99.350	99.363
8230	99.375	99.388	99.400	99.413	99.425	99.438	99.450	99.463	99.475	99.488
8240	99.500	99.513	99.525	99.538	99.550	99.563	99.575	99.588	99.600	99.613
8250	99.625	99.638	99.650	99.663	99.675	99.688	99.700	99.713	99.725	99.738
8260	99.750	99.763	99.775	99.788	99.800	99.813	99.825	99.838	99.850	99.863
8270	99.875	99.888	99.900	99.913	99.925	99.938	99.950	99.963	99.975	99.988
8280	100.000	100.013	100.025	100.038	100.050	100.063	100.075	100.088	100.100	100.113
8290	100.125	100.138	100.150	100.163	100.175	100.188	100.200	100.213	100.225	100.238
8300	100.250	100.263	100.275	100.288	100.300	100.313	100.325	100.338	100.350	100.363
8310	100.375	100.388	95.619	95.631	95.643	95.655	95.667	95.679	95.690	95.702
8320	95.714	95.726	95.738	95.750	95.762	95.774	95.786	95.798	95.810	95.821
8330	95.833	95.845	95.857	95.869	95.881	95.893	95.905	95.917	95.929	95.940
8340	95.952	95.964	95.976	95.988	96.000	96.012	96.024	96.036	96.048	96.060
8350	96.071	96.083	96.095	96.107	96.119	96.131	96.143	96.155	96.167	96.179
8360	96.190	96.202	96.214	96.226	96.238	96.250	96.262	96.274	96.286	96.298
8370	96.310	96.321	96.333	96.345	96.357	96.369	96.381	96.393	96.405	96.417
8380	96.429	96.440	96.452	96.464	96.476	96.488	96.500	96.512	96.524	96.536
8390	96.548	96.560	96.571	96.583	96.595	96.607	96.619	96.631	96.643	96.655
8400	96.667	96.679	96.690	96.702	96.714	96.726	96.738	96.750	96.762	96.774
8410	96.786	96.798	96.810	96.821	96.833	96.845	96.857	96.869	96.881	96.893
8420	96.905	96.917	96.929	96.940	96.952	96.964	96.976	96.988	97.000	97.012
8430	97.024	97.036	97.048	97.060	97.071	97.083	97.095	97.107	97.119	97.131
8440	97.143	97.155	97.167	97.179	97.190	97.202	97.214	97.226	97.238	97.250
8450	97.262	97.274	97.286	97.298	97.310	97.321	97.333	97.345	97.357	97.369
8460	97.381	97.393	97.405	97.417	97.429	97.440	97.452	97.464	97.476	97.488
8470	97.500	97.512	97.524	97.536	97.548	97.560	97.571	97.583	97.595	97.607
8480	97.619	97.631	97.643	97.655	97.667	97.679	97.690	97.702	97.714	97.726
8490	97.738	97.750	97.762	97.774	97.786	97.798	97.810	97.821	97.833	97.845
8500	97.857	97.869	97.881	97.893	97.905	97.917	97.929	97.940	97.952	97.964

SYNTHESIZER FREQUENCIES, TCM-606

	0	1	2	3	4	5	6	7	8	9
10700	100.784	100.794	95.204	95.213	95.222	95.231	95.241	95.250	95.259	95.269
10710	95.278	95.287	95.296	95.306	95.315	95.324	95.333	95.343	95.352	95.361
10720	95.370	95.380	95.389	95.398	95.407	95.417	95.426	95.435	95.444	95.454
10730	95.463	95.472	95.481	95.491	95.500	95.509	95.519	95.528	95.537	95.546
10740	95.556	95.565	95.574	95.583	95.593	95.602	95.611	95.620	95.630	95.639
10750	95.648	95.657	95.667	95.676	95.685	95.694	95.704	95.713	95.722	95.731
10760	95.741	95.750	95.759	95.769	95.778	95.787	95.796	95.806	95.815	95.824
10770	95.833	95.843	95.852	95.861	95.870	95.880	95.889	95.898	95.907	95.917
10780	95.926	95.935	95.944	95.954	95.963	95.972	95.981	95.991	96.000	96.009
10790	96.019	96.028	96.037	96.046	96.056	96.065	96.074	96.083	96.093	96.102
10800	96.111	96.120	96.130	96.139	96.148	96.157	96.167	96.176	96.185	96.194
10810	96.204	96.213	96.222	96.231	96.241	96.250	96.259	96.269	96.278	96.287
10820	96.296	96.306	96.315	96.324	96.333	96.343	96.352	96.361	96.370	96.380
10830	96.389	96.398	96.407	96.417	96.426	96.435	96.444	96.454	96.463	96.472
10840	96.481	96.491	96.500	96.509	96.519	96.528	96.537	96.546	96.556	96.565
10850	96.574	96.583	96.593	96.602	96.611	96.620	96.630	96.639	96.648	96.657
10860	96.667	96.676	96.685	96.694	96.704	96.713	96.722	96.731	96.741	96.750
10870	96.759	96.769	96.778	96.787	96.796	96.806	96.815	96.824	96.833	96.843
10880	96.852	96.861	96.870	96.880	96.889	96.898	96.907	96.917	96.926	96.935
10890	96.944	96.954	96.963	96.972	96.981	96.991	97.000	97.009	97.019	97.028
10900	97.037	97.046	97.056	97.065	97.074	97.083	97.093	97.102	97.111	97.120
10910	97.130	97.139	97.148	97.157	97.167	97.176	97.185	97.194	97.204	97.213
10920	97.222	97.231	97.241	97.250	97.259	97.269	97.278	97.287	97.296	97.306
10930	97.315	97.324	97.333	97.343	97.352	97.361	97.370	97.380	97.389	97.398
10940	97.407	97.417	97.426	97.435	97.444	97.454	97.463	97.472	97.481	97.491
10950	97.500	97.509	97.519	97.528	97.537	97.546	97.556	97.565	97.574	97.583
10960	97.593	97.602	97.611	97.620	97.630	97.639	97.648	97.657	97.667	97.676
10970	97.685	97.694	97.704	97.713	97.722	97.731	97.741	97.750	97.759	97.769
10980	97.778	97.787	97.796	97.806	97.815	97.824	97.833	97.843	97.852	97.861
10990	97.870	97.880	97.889	97.898	97.907	97.917	97.926	97.935	97.944	97.954
11000	97.963	97.972	97.981	97.991	98.000	98.009	98.019	98.028	98.037	98.046
11010	98.056	98.065	98.074	98.083	98.093	98.102	98.111	98.120	98.130	98.139
11020	98.148	98.157	98.167	98.176	98.185	98.194	98.204	98.213	98.222	98.231
11030	98.241	98.250	98.259	98.269	98.278	98.287	98.296	98.306	98.315	98.324
11040	98.333	98.343	98.352	98.361	98.370	98.380	98.389	98.398	98.407	98.417
11050	98.426	98.435	98.444	98.454	98.463	98.472	98.481	98.491	98.500	98.509
11060	98.519	98.528	98.537	98.546	98.556	98.565	98.574	98.583	98.593	98.602
11070	98.611	98.620	98.630	98.639	98.648	98.657	98.667	98.676	98.685	98.694
11080	98.704	98.713	98.722	98.731	98.741	98.750	98.759	98.769	98.778	98.787
11090	98.796	98.806	98.815	98.824	98.833	98.843	98.852	98.861	98.870	98.880
11100	98.889	98.898	98.907	98.917	98.926	98.935	98.944	98.954	98.963	98.972
11110	98.981	98.991	99.000	99.009	99.019	99.028	99.037	99.046	99.056	99.065
11120	99.074	99.083	99.093	99.102	99.111	99.120	99.130	99.139	99.148	99.157
11130	99.167	99.176	99.185	99.194	99.204	99.213	99.222	99.231	99.241	99.250
11140	99.259	99.269	99.278	99.287	99.296	99.306	99.315	99.324	99.333	99.343
11150	99.352	99.361	99.370	99.380	99.389	99.398	99.407	99.417	99.426	99.435
11160	99.444	99.454	99.463	99.472	99.481	99.491	99.500	99.509	99.519	99.528
11170	99.537	99.546	99.556	99.565	99.574	99.583	99.593	99.602	99.611	99.620
11180	99.630	99.639	99.648	99.657	99.667	99.676	99.685	99.694	99.704	99.713
11190	99.722	99.731	99.741	99.750	99.759	99.769	99.778	99.787	99.796	99.806

SYNTHESIZER FREQUENCIES, TCM-606

	0	1	2	3	4	5	6	7	8	9
11200	99.815	99.824	99.833	99.843	99.852	99.861	99.870	99.880	99.889	99.898
11210	99.907	99.917	99.926	99.935	99.944	99.954	99.963	99.972	99.981	99.991
11220	100.000	100.009	100.019	100.028	100.037	100.046	100.056	100.065	100.074	100.083
11230	100.093	100.102	100.111	100.120	100.130	100.139	100.148	100.157	100.167	100.176
11240	100.185	100.194	100.204	100.213	100.222	100.231	100.241	100.250	100.259	100.269
11250	100.278	100.287	100.296	100.306	100.315	100.324	100.333	100.343	100.352	100.361
11260	100.370	100.380	100.389	100.398	100.407	100.417	100.426	100.435	100.444	100.454
11270	100.463	100.472	100.481	100.491	100.500	100.509	100.519	100.528	100.537	100.546
11280	100.556	100.565	100.574	100.583	100.593	100.602	100.611	100.620	100.630	100.639
11290	100.648	95.360	95.368	95.377	95.386	95.395	95.404	95.412	95.421	95.430
11300	95.439	95.447	95.456	95.465	95.474	95.482	95.491	95.500	95.509	95.518
11310	95.526	95.535	95.544	95.553	95.561	95.570	95.579	95.588	95.596	95.605
11320	95.614	95.623	95.632	95.640	95.649	95.658	95.667	95.675	95.684	95.693
11330	95.702	95.711	95.719	95.728	95.737	95.746	95.754	95.763	95.772	95.781
11340	95.789	95.798	95.807	95.816	95.825	95.833	95.842	95.851	95.860	95.868
11350	95.877	95.886	95.895	95.904	95.912	95.921	95.930	95.939	95.947	95.956
11360	95.965	95.974	95.982	95.991	96.000	96.009	96.018	96.026	96.035	96.044
11370	96.053	96.061	96.070	96.079	96.088	96.096	96.105	96.114	96.123	96.132
11380	96.140	96.149	96.158	96.167	96.175	96.184	96.193	96.202	96.211	96.219
11390	96.228	96.237	96.246	96.254	96.263	96.272	96.281	96.289	96.298	96.307
11400	96.316	96.325	96.333	96.342	96.351	96.360	96.368	96.377	96.386	96.395
11410	96.404	96.412	96.421	96.430	96.439	96.447	96.456	96.465	96.474	96.482
11420	96.491	96.500	96.509	96.518	96.526	96.535	96.544	96.553	96.561	96.570
11430	96.579	96.588	96.596	96.605	96.614	96.623	96.632	96.640	96.649	96.658
11440	96.667	96.675	96.684	96.693	96.702	96.711	96.719	96.728	96.737	96.746
11450	96.754	96.763	96.772	96.781	96.789	96.798	96.807	96.816	96.825	96.833
11460	96.842	96.851	96.860	96.868	96.877	96.886	96.895	96.904	96.912	96.921
11470	96.930	96.939	96.947	96.956	96.965	96.974	96.982	96.991	97.000	97.009
11480	97.018	97.026	97.035	97.044	97.053	97.061	97.070	97.079	97.088	97.096
11490	97.105	97.114	97.123	97.132	97.140	97.149	97.158	97.167	97.175	97.184
11500	97.193	97.202	97.211	97.219	97.228	97.237	97.246	97.254	97.263	97.272
11510	97.281	97.289	97.298	97.307	97.316	97.325	97.333	97.342	97.351	97.360
11520	97.368	97.377	97.386	97.395	97.404	97.412	97.421	97.430	97.439	97.447
11530	97.456	97.465	97.474	97.482	97.491	97.500	97.509	97.518	97.526	97.535
11540	97.544	97.553	97.561	97.570	97.579	97.588	97.596	97.605	97.614	97.623
11550	97.632	97.640	97.649	97.658	97.667	97.675	97.684	97.693	97.702	97.711
11560	97.719	97.728	97.737	97.746	97.754	97.763	97.772	97.781	97.789	97.798
11570	97.807	97.816	97.825	97.833	97.842	97.851	97.860	97.868	97.877	97.886
11580	97.895	97.904	97.912	97.921	97.930	97.939	97.947	97.956	97.965	97.974
11590	97.982	97.991	98.000	98.009	98.018	98.026	98.035	98.044	98.053	98.061
11600	98.070	98.079	98.088	98.096	98.105	98.114	98.123	98.132	98.140	98.149
11610	98.158	98.167	98.175	98.184	98.193	98.202	98.211	98.219	98.228	98.237
11620	98.246	98.254	98.263	98.272	98.281	98.289	98.298	98.307	98.316	98.325
11630	98.333	98.342	98.351	98.360	98.368	98.377	98.386	98.395	98.404	98.412
11640	98.421	98.430	98.439	98.447	98.456	98.465	98.474	98.482	98.491	98.500
11650	98.509	98.518	98.526	98.535	98.544	98.553	98.561	98.570	98.579	98.588
11660	98.596	98.605	98.614	98.623	98.632	98.640	98.649	98.658	98.667	98.675
11670	98.684	98.693	98.702	98.711	98.719	98.728	98.737	98.746	98.754	98.763
11680	98.772	98.781	98.789	98.798	98.807	98.816	98.825	98.833	98.842	98.851
11690	98.860	98.868	98.877	98.886	98.895	98.904	98.912	98.921	98.930	98.939

SYNTHESIZER FREQUENCIES, TCM-606

	0	1	2	3	4	5	6	7	8	9
11700	98.947	98.956	98.965	98.974	98.982	98.991	99.000	99.009	99.018	99.026
11710	99.035	99.044	99.053	99.061	99.070	99.079	99.088	99.096	99.105	99.114
11720	99.123	99.132	99.140	99.149	99.158	99.167	99.175	99.184	99.193	99.202
11730	99.211	99.219	99.228	99.237	99.246	99.254	99.263	99.272	99.281	99.289
11740	99.298	99.307	99.316	99.325	99.333	99.342	99.351	99.360	99.368	99.377
11750	99.386	99.395	99.404	99.412	99.421	99.430	99.439	99.447	99.456	99.465
11760	99.474	99.482	99.491	99.500	99.509	99.518	99.526	99.535	99.544	99.553
11770	99.561	99.570	99.579	99.588	99.596	99.605	99.614	99.623	99.632	99.640
11780	99.649	99.658	99.667	99.675	99.684	99.693	99.702	99.711	99.719	99.728
11790	99.737	99.746	99.754	99.763	99.772	99.781	99.789	99.798	99.807	99.816
11800	99.825	99.833	99.842	99.851	99.860	99.868	99.877	99.886	99.895	99.904
11810	99.912	99.921	99.930	99.939	99.947	99.956	99.965	99.974	99.982	99.991
11820	100.000	100.009	100.018	100.026	100.035	100.044	100.053	100.061	100.070	100.079
11830	100.088	100.096	100.105	100.114	100.123	100.132	100.140	100.149	100.158	100.167
11840	100.175	100.184	100.193	100.202	100.211	100.219	100.228	100.237	100.246	100.254
11850	100.263	100.272	100.281	100.289	100.298	100.307	100.316	100.325	100.333	100.342
11860	100.351	100.360	100.368	100.377	100.386	100.395	100.404	100.412	100.421	100.430
11870	100.439	100.447	100.456	100.465	100.474	100.482	100.491	100.500	100.509	95.492
11880	95.500	95.508	95.517	95.525	95.533	95.542	95.550	95.558	95.567	95.575
11890	95.583	95.592	95.600	95.608	95.617	95.625	95.633	95.642	95.650	95.658
11900	95.667	95.675	95.683	95.692	95.700	95.708	95.717	95.725	95.733	95.742
11910	95.750	95.758	95.767	95.775	95.783	95.792	95.800	95.808	95.817	95.825
11920	95.833	95.842	95.850	95.858	95.867	95.875	95.883	95.892	95.900	95.908
11930	95.917	95.925	95.933	95.942	95.950	95.958	95.967	95.975	95.983	95.992
11940	96.000	96.008	96.017	96.025	96.033	96.042	96.050	96.058	96.067	96.075
11950	96.083	96.092	96.100	96.108	96.117	96.125	96.133	96.142	96.150	96.158
11960	96.167	96.175	96.183	96.192	96.200	96.208	96.217	96.225	96.233	96.242
11970	96.250	96.258	96.267	96.275	96.283	96.292	96.300	96.308	96.317	96.325
11980	96.333	96.342	96.350	96.358	96.367	96.375	96.383	96.392	96.400	96.408
11990	96.417	96.425	96.433	96.442	96.450	96.458	96.467	96.475	96.483	96.492
12000	96.500	96.508	96.517	96.525	96.533	96.542	96.550	96.558	96.567	96.575
12010	96.583	96.592	96.600	96.608	96.617	96.625	96.633	96.642	96.650	96.658
12020	96.667	96.675	96.683	96.692	96.700	96.708	96.717	96.725	96.733	96.742
12030	96.750	96.758	96.767	96.775	96.783	96.792	96.800	96.808	96.817	96.825
12040	96.833	96.842	96.850	96.858	96.867	96.875	96.883	96.892	96.900	96.908
12050	96.917	96.925	96.933	96.942	96.950	96.958	96.967	96.975	96.983	96.992
12060	97.000	97.008	97.017	97.025	97.033	97.042	97.050	97.058	97.067	97.075
12070	97.083	97.092	97.100	97.108	97.117	97.125	97.133	97.142	97.150	97.158
12080	97.167	97.175	97.183	97.192	97.200	97.208	97.217	97.225	97.233	97.242
12090	97.250	97.258	97.267	97.275	97.283	97.292	97.300	97.308	97.317	97.325
12100	97.333	97.342	97.350	97.358	97.367	97.375	97.383	97.392	97.400	97.408
12110	97.417	97.425	97.433	97.442	97.450	97.458	97.467	97.475	97.483	97.492
12120	97.500	97.508	97.517	97.525	97.533	97.542	97.550	97.558	97.567	97.575
12130	97.583	97.592	97.600	97.608	97.617	97.625	97.633	97.642	97.650	97.658
12140	97.667	97.675	97.683	97.692	97.700	97.708	97.717	97.725	97.733	97.742
12150	97.750	97.758	97.767	97.775	97.783	97.792	97.800	97.808	97.817	97.825
12160	97.833	97.842	97.850	97.858	97.867	97.875	97.883	97.892	97.900	97.908
12170	97.917	97.925	97.933	97.942	97.950	97.958	97.967	97.975	97.983	97.992
12180	98.000	98.008	98.017	98.025	98.033	98.042	98.050	98.058	98.067	98.075
12190	98.083	98.092	98.100	98.108	98.117	98.125	98.133	98.142	98.150	98.158

SYNTHESIZER FREQUENCIES, TCM-606

	0	1	2	3	4	5	6	7	8	9
12200	98.167	98.175	98.183	98.192	98.200	98.208	98.217	98.225	98.233	98.242
12210	98.250	98.258	98.267	98.275	98.283	98.292	98.300	98.308	98.317	98.325
12220	98.333	98.342	98.350	98.358	98.367	98.375	98.383	98.392	98.400	98.408
12230	98.417	98.425	98.433	98.442	98.450	98.458	98.467	98.475	98.483	98.492
12240	98.500	98.508	98.517	98.525	98.533	98.542	98.550	98.558	98.567	98.575
12250	98.583	98.592	98.600	98.608	98.617	98.625	98.633	98.642	98.650	98.658
12260	98.667	98.675	98.683	98.692	98.700	98.708	98.717	98.725	98.733	98.742
12270	98.750	98.758	98.767	98.775	98.783	98.792	98.800	98.808	98.817	98.825
12280	98.833	98.842	98.850	98.858	98.867	98.875	98.883	98.892	98.900	98.908
12290	98.917	98.925	98.933	98.942	98.950	98.958	98.967	98.975	98.983	98.992
12300	99.000	99.008	99.017	99.025	99.033	99.042	99.050	99.058	99.067	99.075
12310	99.083	99.092	99.100	99.108	99.117	99.125	99.133	99.142	99.150	99.158
12320	99.167	99.175	99.183	99.192	99.200	99.208	99.217	99.225	99.233	99.242
12330	99.250	99.258	99.267	99.275	99.283	99.292	99.300	99.308	99.317	99.325
12340	99.333	99.342	99.350	99.358	99.367	99.375	99.383	99.392	99.400	99.408
12350	99.417	99.425	99.433	99.442	99.450	99.458	99.467	99.475	99.483	99.492
12360	99.500	99.508	99.517	99.525	99.533	99.542	99.550	99.558	99.567	99.575
12370	99.583	99.592	99.600	99.608	99.617	99.625	99.633	99.642	99.650	99.658
12380	99.667	99.675	99.683	99.692	99.700	99.708	99.717	99.725	99.733	99.742
12390	99.750	99.758	99.767	99.775	99.783	99.792	99.800	99.808	99.817	99.825
12400	99.833	99.842	99.850	99.858	99.867	99.875	99.883	99.892	99.900	99.908
12410	99.917	99.925	99.933	99.942	99.950	99.958	99.967	99.975	99.983	99.992
12420	100.000	100.008	100.017	100.025	100.033	100.042	100.050	100.058	100.067	100.075
12430	100.083	100.092	100.100	100.108	100.117	100.125	100.133	100.142	100.150	100.158
12440	100.167	100.175	100.183	100.192	100.200	100.208	100.217	100.225	100.233	100.242
12450	100.250	100.258	100.267	100.275	100.283	100.292	100.300	100.308	100.317	100.325
12460	100.333	100.342	100.350	100.358	100.367	100.375	100.383	95.611	95.619	95.627
12470	95.635	95.643	95.651	95.659	95.667	95.675	95.683	95.690	95.698	95.706
12480	95.714	95.722	95.730	95.738	95.746	95.754	95.762	95.770	95.778	95.786
12490	95.794	95.802	95.810	95.817	95.825	95.833	95.841	95.849	95.857	95.865
12500	95.873	95.881	95.889	95.897	95.905	95.913	95.921	95.929	95.937	95.944
12510	95.952	95.960	95.968	95.976	95.984	95.992	96.000	96.008	96.016	96.024
12520	96.032	96.040	96.048	96.056	96.064	96.071	96.079	96.087	96.095	96.103
12530	96.111	96.119	96.127	96.135	96.143	96.151	96.159	96.167	96.175	96.183
12540	96.190	96.198	96.206	96.214	96.222	96.230	96.238	96.246	96.254	96.262
12550	96.270	96.278	96.286	96.294	96.302	96.310	96.317	96.325	96.333	96.341
12560	96.349	96.357	96.365	96.373	96.381	96.389	96.397	96.405	96.413	96.421
12570	96.429	96.437	96.444	96.452	96.460	96.468	96.476	96.484	96.492	96.500
12580	96.508	96.516	96.524	96.532	96.540	96.548	96.556	96.564	96.571	96.579
12590	96.587	96.595	96.603	96.611	96.619	96.627	96.635	96.643	96.651	96.659
12600	96.667	96.675	96.683	96.690	96.698	96.706	96.714	96.722	96.730	96.738
12610	96.746	96.754	96.762	96.770	96.778	96.786	96.794	96.802	96.810	96.817
12620	96.825	96.833	96.841	96.849	96.857	96.865	96.873	96.881	96.889	96.897
12630	96.905	96.913	96.921	96.929	96.937	96.944	96.952	96.960	96.968	96.976
12640	96.984	96.992	97.000	97.008	97.016	97.024	97.032	97.040	97.048	97.056
12650	97.064	97.071	97.079	97.087	97.095	97.103	97.111	97.119	97.127	97.135
12660	97.143	97.151	97.159	97.167	97.175	97.183	97.190	97.198	97.206	97.214
12670	97.222	97.230	97.238	97.246	97.254	97.262	97.270	97.278	97.286	97.294
12680	97.302	97.310	97.317	97.325	97.333	97.341	97.349	97.357	97.365	97.373
12690	97.381	97.389	97.397	97.405	97.413	97.421	97.429	97.437	97.444	97.452

	0	1	2	3	4	5	6	7	8	9
12700	97.460	97.468	97.476	97.484	97.492	97.500	97.508	97.516	97.524	97.532
12710	97.540	97.548	97.556	97.564	97.571	97.579	97.587	97.595	97.603	97.611
12720	97.619	97.627	97.635	97.643	97.651	97.659	97.667	97.675	97.683	97.690
12730	97.698	97.706	97.714	97.722	97.730	97.738	97.746	97.754	97.762	97.770
12740	97.778	97.786	97.794	97.802	97.810	97.817	97.825	97.833	97.841	97.849
12750	97.857	97.865	97.873	97.881	97.889	97.897	97.905	97.913	97.921	97.929
12760	97.937	97.944	97.952	97.960	97.968	97.976	97.984	97.992	98.000	98.008
12770	98.016	98.024	98.032	98.040	98.048	98.056	98.064	98.071	98.079	98.087
12780	98.095	98.103	98.111	98.119	98.127	98.135	98.143	98.151	98.159	98.167
12790	98.175	98.183	98.190	98.198	98.206	98.214	98.222	98.230	98.238	98.246
12800	98.254	98.262	98.270	98.278	98.286	98.294	98.302	98.310	98.317	98.325
12810	98.333	98.341	98.349	98.357	98.365	98.373	98.381	98.389	98.397	98.405
12820	98.413	98.421	98.429	98.437	98.444	98.452	98.460	98.468	98.476	98.484
12830	98.492	98.500	98.508	98.516	98.524	98.532	98.540	98.548	98.556	98.564
12840	98.571	98.579	98.587	98.595	98.603	98.611	98.619	98.627	98.635	98.643
12850	98.651	98.659	98.667	98.675	98.683	98.690	98.698	98.706	98.714	98.722
12860	98.730	98.738	98.746	98.754	98.762	98.770	98.778	98.786	98.794	98.802
12870	98.810	98.817	98.825	98.833	98.841	98.849	98.857	98.865	98.873	98.881
12880	98.889	98.897	98.905	98.913	98.921	98.929	98.937	98.944	98.952	98.960
12890	98.968	98.976	98.984	98.992	99.000	99.008	99.016	99.024	99.032	99.040
12900	99.048	99.056	99.064	99.071	99.079	99.087	99.095	99.103	99.111	99.119
12910	99.127	99.135	99.143	99.151	99.159	99.167	99.175	99.183	99.190	99.198
12920	99.206	99.214	99.222	99.230	99.238	99.246	99.254	99.262	99.270	99.278
12930	99.286	99.294	99.302	99.310	99.317	99.325	99.333	99.341	99.349	99.357
12940	99.365	99.373	99.381	99.389	99.397	99.405	99.413	99.421	99.429	99.437
12950	99.444	99.452	99.460	99.468	99.476	99.484	99.492	99.500	99.508	99.516
12960	99.524	99.532	99.540	99.548	99.556	99.564	99.571	99.579	99.587	99.595
12970	99.603	99.611	99.619	99.627	99.635	99.643	99.651	99.659	99.667	99.675
12980	99.683	99.690	99.698	99.706	99.714	99.722	99.730	99.738	99.746	99.754
12990	99.762	99.770	99.778	99.786	99.794	99.802	99.810	99.817	99.825	99.833
13000	99.841	99.849	99.857	99.865	99.873	99.881	99.889	99.897	99.905	99.913
13010	99.921	99.929	99.937	99.944	99.952	99.960	99.968	99.976	99.984	99.992
13020	100.000	100.008	100.016	100.024	100.032	100.040	100.048	100.056	100.064	100.071
13030	100.079	100.087	100.095	100.103	100.111	100.119	100.127	100.135	100.143	100.151
13040	100.159	100.167	100.175	100.183	100.190	100.198	100.206	100.214	100.222	100.230
13050	100.238	100.246	100.254	100.262	100.270	100.278	95.727	95.735	95.742	95.750
13060	95.758	95.765	95.773	95.780	95.788	95.795	95.803	95.811	95.818	95.826
13070	95.833	95.841	95.848	95.856	95.864	95.871	95.879	95.886	95.894	95.902
13080	95.909	95.917	95.924	95.932	95.939	95.947	95.955	95.962	95.970	95.977
13090	95.985	95.992	96.000	96.008	96.015	96.023	96.030	96.038	96.045	96.053
13100	96.061	96.068	96.076	96.083	96.091	96.098	96.106	96.114	96.121	96.129
13110	96.136	96.144	96.152	96.159	96.167	96.174	96.182	96.189	96.197	96.205
13120	96.212	96.220	96.227	96.235	96.242	96.250	96.258	96.265	96.273	96.280
13130	96.288	96.295	96.303	96.311	96.318	96.326	96.333	96.341	96.348	96.356
13140	96.364	96.371	96.379	96.386	96.394	96.402	96.409	96.417	96.424	96.432
13150	96.439	96.447	96.455	96.462	96.470	96.477	96.485	96.492	96.500	96.508
13160	96.515	96.523	96.530	96.538	96.545	96.553	96.561	96.568	96.576	96.583
13170	96.591	96.598	96.606	96.614	96.621	96.629	96.636	96.644	96.652	96.659
13180	96.667	96.674	96.682	96.689	96.697	96.705	96.712	96.720	96.727	96.735
13190	96.742	96.750	96.758	96.765	96.773	96.780	96.788	96.795	96.803	96.811

SYNTHESIZER FREQUENCIES, TCM-606

	0	1	2	3	4	5	6	7	8	9
13200	96.818	96.826	96.833	96.841	96.848	96.856	96.864	96.871	96.879	96.886
13210	96.894	96.902	96.909	96.917	96.924	96.932	96.939	96.947	96.955	96.962
13220	96.970	96.977	96.985	96.992	97.000	97.008	97.015	97.023	97.030	97.038
13230	97.045	97.053	97.061	97.068	97.076	97.083	97.091	97.098	97.106	97.114
13240	97.121	97.129	97.136	97.144	97.152	97.159	97.167	97.174	97.182	97.189
13250	97.197	97.205	97.212	97.220	97.227	97.235	97.242	97.250	97.258	97.265
13260	97.273	97.280	97.288	97.295	97.303	97.311	97.318	97.326	97.333	97.341
13270	97.348	97.356	97.364	97.371	97.379	97.386	97.394	97.402	97.409	97.417
13280	97.424	97.432	97.439	97.447	97.455	97.462	97.470	97.477	97.485	97.492
13290	97.500	97.508	97.515	97.523	97.530	97.538	97.545	97.553	97.561	97.568
13300	97.576	97.583	97.591	97.598	97.606	97.614	97.621	97.629	97.636	97.644

SYNTHESIZER FREQUENCIES, TCM-608

	0	1	2	3	4	5	6	7	8	9
13800	97.353	97.360	97.368	97.375	97.382	97.390	97.397	97.404	97.412	97.419
13810	97.426	97.434	97.441	97.449	97.456	97.463	97.471	97.478	97.485	97.493
13820	97.500	97.507	97.515	97.522	97.529	97.537	97.544	97.551	97.559	97.566
13830	97.574	97.581	97.588	97.596	97.603	97.610	97.618	97.625	97.632	97.640
13840	97.647	97.654	97.662	97.669	97.676	97.684	97.691	97.699	97.706	97.713
13850	97.721	97.728	97.735	97.743	97.750	97.757	97.765	97.772	97.779	97.787
13860	97.794	97.801	97.809	97.816	97.824	97.831	97.838	97.846	97.853	97.860
13870	97.868	97.875	97.882	97.890	97.897	97.904	97.912	97.919	97.926	97.934
13880	97.941	97.949	97.956	97.963	97.971	97.978	97.985	97.993	98.000	98.007
13890	98.015	98.022	98.029	98.037	98.044	98.051	98.059	98.066	98.074	98.081
13900	98.088	98.096	98.103	98.110	98.118	98.125	98.132	98.140	98.147	98.154
13910	98.162	98.169	98.176	98.184	98.191	98.199	98.206	98.213	98.221	98.228
13920	90.235	98.243	98.250	98.257	98.265	98.272	98.279	98.287	98.294	98.301
13930	98.309	98.316	98.324	98.331	98.338	98.346	98.353	98.360	98.368	98.375
13940	98.382	98.390	98.397	98.404	98.412	98.419	98.426	98.434	98.441	98.449
13950	98.456	98.463	98.471	98.478	98.485	98.493	98.500	98.507	98.515	98.522
13960	98.529	98.537	98.544	98.551	98.559	98.566	98.574	98.581	98.588	98.596
13970	98.603	98.610	98.618	98.625	98.632	98.640	98.647	98.654	98.662	98.669
13980	98.676	98.684	98.691	98.699	98.706	98.713	98.721	98.728	98.735	98.743
13990	98.750	98.757	98.765	98.772	98.779	98.787	98.794	98.801	98.809	98.816
14000	98.824	98.831	98.838	98.846	98.853	98.860	98.868	98.875	98.882	98.890
14010	98.897	98.904	98.912	98.919	98.926	98.934	98.941	98.949	98.956	98.963
14020	98.971	98.978	98.985	98.993	99.000	99.007	99.015	99.022	99.029	99.037
14030	99.044	99.051	99.059	99.066	99.074	99.081	99.088	99.096	99.103	99.110
14040	99.118	99.125	99.132	99.140	99.147	99.154	99.162	99.169	99.176	99.184
14050	99.191	99.199	99.206	99.213	99.221	99.228	99.235	99.243	99.250	99.257
14060	99.265	99.272	99.279	99.287	99.294	99.301	99.309	99.316	99.324	99.331
14070	99.338	99.346	99.353	99.360	99.368	99.375	99.382	99.390	99.397	99.404
14080	99.412	99.419	99.426	99.434	99.441	99.449	99.456	99.463	99.471	99.478
14090	99.485	99.493	99.500	99.507	99.515	99.522	99.529	99.537	99.544	99.551
14100	99.559	99.566	99.574	99.581	99.588	99.596	99.603	99.610	99.618	99.625
14110	99.632	99.640	99.647	99.654	99.662	99.669	99.676	99.684	99.691	99.699
14120	99.706	99.713	99.721	99.728	99.735	99.743	99.750	99.757	99.765	99.772
14130	99.779	99.787	99.794	99.801	99.809	99.816	99.824	99.831	99.838	99.846
14140	99.853	99.860	99.868	99.875	99.882	99.890	99.897	99.904	99.912	99.919
14150	99.926	99.934	99.941	99.949	99.956	99.963	99.971	99.978	99.985	99.993
14160	100.000	100.007	100.015	100.022	100.029	100.037	100.044	100.051	100.059	100.066
14170	100.074	100.081	100.088	100.096	100.103	100.110	100.118	100.125	100.132	100.140
14180	100.147	100.154	100.162	100.169	100.176	100.184	100.191	100.199	100.206	100.213
14190	100.221	100.228	100.235	100.243	100.250	100.257	100.265	100.272	100.279	100.287
14200	100.294	100.301	100.309	100.316	100.324	100.331	100.338	100.346	100.353	100.360
14210	100.368	100.375	100.382	100.390	100.397	100.404	100.412	100.419	100.426	100.434
14220	100.441	100.449	100.456	100.463	100.471	100.478	100.485	100.493	100.500	100.507
14230	100.515	100.522	100.529	100.537	100.544	100.551	100.559	100.566	100.574	100.581
14240	100.588	100.596	100.603	100.610	100.618	100.625	100.632	100.640	100.647	100.654
14250	100.662	100.669	100.676	100.684	100.691	100.699	100.706	100.713	100.721	100.729
14260	100.735	100.743	100.750	100.757	100.765	100.772	100.779	100.787	100.794	95.201
14270	95.208	95.215	95.222	95.229	95.236	95.243	95.250	95.257	95.264	95.271
14280	95.278	95.285	95.292	95.299	95.306	95.313	95.319	95.326	95.333	95.340
14290	95.347	95.354	95.361	95.368	95.375	95.382	95.389	95.396	95.403	95.410

SYNTHESIZER FREQUENCIES, TCM-608

	0	1	2	3	4	5	6	7	8	9
14300	95.417	95.424	95.431	95.438	95.444	95.451	95.458	95.465	95.472	95.479
14310	95.486	95.493	95.500	95.507	95.514	95.521	95.528	95.535	95.542	95.549
14320	95.556	95.563	95.569	95.576	95.583	95.590	95.597	95.604	95.611	95.618
14330	95.625	95.632	95.639	95.646	95.653	95.660	95.667	95.674	95.681	95.688
14340	95.694	95.701	95.708	95.715	95.722	95.729	95.736	95.743	95.750	95.757
14350	95.764	95.771	95.778	95.785	95.792	95.799	95.806	95.813	95.819	95.826
14360	95.833	95.840	95.847	95.854	95.861	95.868	95.875	95.882	95.889	95.896
14370	95.903	95.910	95.917	95.924	95.931	95.938	95.944	95.951	95.958	95.965
14380	95.972	95.979	95.986	95.993	96.000	96.007	96.014	96.021	96.028	96.035
14390	96.042	96.049	96.056	96.063	96.069	96.076	96.083	96.090	96.097	96.104
14400	96.111	96.118	96.125	96.132	96.139	96.146	96.153	96.160	96.167	96.174
14410	96.181	96.188	96.194	96.201	96.208	96.215	96.222	96.229	96.236	96.243
14420	96.250	96.257	96.264	96.271	96.278	96.285	96.292	96.299	96.306	96.313
14430	96.319	96.326	96.333	96.340	96.347	96.354	96.361	96.368	96.375	96.382
14440	96.389	96.396	96.403	96.410	96.417	96.424	96.431	96.438	96.444	96.451
14450	96.458	96.465	96.472	96.479	96.486	96.493	96.500	96.507	96.514	96.521
14460	96.528	96.535	96.542	96.549	96.556	96.563	96.569	96.576	96.583	96.590
14470	96.597	96.604	96.611	96.618	96.625	96.632	96.639	96.646	96.653	96.660
14480	96.667	96.674	96.681	96.688	96.694	96.701	96.708	96.715	96.722	96.729
14490	96.736	96.743	96.750	96.757	96.764	96.771	96.778	96.785	96.792	96.799
14500	96.806	96.813	96.819	96.826	96.833	96.840	96.847	96.854	96.861	96.868
14510	96.875	96.882	96.889	96.896	96.903	96.910	96.917	96.924	96.931	96.938
14520	96.944	96.951	96.958	96.965	96.972	96.979	96.986	96.993	97.000	97.007
14530	97.014	97.021	97.028	97.035	97.042	97.049	97.056	97.063	97.069	97.076
14540	97.083	97.090	97.097	97.104	97.111	97.118	97.125	97.132	97.139	97.146
14550	97.153	97.160	97.167	97.174	97.181	97.188	97.194	97.201	97.208	97.215
14560	97.222	97.229	97.236	97.243	97.250	97.257	97.264	97.271	97.278	97.285
14570	97.292	97.299	97.306	97.313	97.319	97.326	97.333	97.340	97.347	97.354
14580	97.361	97.368	97.375	97.382	97.389	97.396	97.403	97.410	97.417	97.424
14590	97.431	97.438	97.444	97.451	97.458	97.465	97.472	97.479	97.486	97.493
14600	97.500	97.507	97.514	97.521	97.528	97.535	97.542	97.549	97.556	97.563
14610	97.569	97.576	97.583	97.590	97.597	97.604	97.611	97.618	97.625	97.632
14620	97.639	97.646	97.653	97.660	97.667	97.674	97.681	97.688	97.694	97.701
14630	97.708	97.715	97.722	97.729	97.736	97.743	97.750	97.757	97.764	97.771
14640	97.778	97.785	97.792	97.799	97.806	97.813	97.819	97.826	97.833	97.840
14650	97.847	97.854	97.861	97.868	97.875	97.882	97.889	97.896	97.903	97.910
14660	97.917	97.924	97.931	97.938	97.944	97.951	97.958	97.965	97.972	97.979
14670	97.986	97.993	98.000	98.007	98.014	98.021	98.028	98.035	98.042	98.049
14680	98.056	98.063	98.069	98.076	98.083	98.090	98.097	98.104	98.111	98.118
14690	98.125	98.132	98.139	98.146	98.153	98.160	98.167	98.174	98.181	98.188
14700	98.194	98.201	98.208	98.215	98.222	98.229	98.236	98.243	98.250	98.257
14710	98.264	98.271	98.278	98.285	98.292	98.299	98.306	98.313	98.319	98.326
14720	98.333	98.340	98.347	98.354	98.361	98.368	98.375	98.382	98.389	98.396
14730	98.403	98.410	98.417	98.424	98.431	98.438	98.444	98.451	98.458	98.465
14740	98.472	98.479	98.486	98.493	98.500	98.507	98.514	98.521	98.528	98.535
14750	98.542	98.549	98.556	98.563	98.569	98.576	98.583	98.590	98.597	98.604
14760	98.611	98.618	98.625	98.632	98.639	98.646	98.653	98.660	98.667	98.674
14770	98.681	98.688	98.694	98.701	98.708	98.715	98.722	98.729	98.736	98.743
14780	98.750	98.757	98.764	98.771	98.778	98.785	98.792	98.799	98.806	98.813
14790	98.819	98.826	98.833	98.840	98.847	98.854	98.861	98.868	98.875	98.882

SYNTHESIZER FREQUENCIES, TCM-608

	0	1	2	3	4	5	6	7	8	9
14800	98.889	98.896	98.903	98.910	98.917	98.924	98.931	98.938	98.944	98.951
14810	98.958	98.965	98.972	98.979	98.986	98.993	99.000	99.007	99.014	99.021
14820	99.028	99.035	99.042	99.049	99.056	99.063	99.069	99.076	99.083	99.090
14830	99.097	99.104	99.111	99.118	99.125	99.132	99.139	99.146	99.153	99.160
14840	99.167	99.174	99.181	99.188	99.194	99.201	99.208	99.215	99.222	99.229
14850	99.236	99.243	99.250	99.257	99.264	99.271	99.278	99.285	99.292	99.299
14860	99.306	99.313	99.319	99.326	99.333	99.340	99.347	99.354	99.361	99.368
14870	99.375	99.382	99.389	99.396	99.403	99.410	99.417	99.424	99.431	99.438
14880	99.444	99.451	99.458	99.465	99.472	99.479	99.486	99.493	99.500	99.507
14890	99.514	99.521	99.528	99.535	99.542	99.549	99.556	99.563	99.569	99.576
14900	99.583	99.590	99.597	99.604	99.611	99.618	99.625	99.632	99.639	99.646
14910	99.653	99.660	99.667	99.674	99.681	99.688	99.694	99.701	99.708	99.715
14920	99.722	99.729	99.736	99.743	99.750	99.757	99.764	99.771	99.778	99.785
14930	99.792	99.799	99.806	99.813	99.819	99.826	99.833	99.840	99.847	99.854
14940	99.861	99.868	99.875	99.882	99.889	99.896	99.903	99.910	99.917	99.924
14950	99.931	99.938	99.944	99.951	99.958	99.965	99.972	99.979	99.986	99.993
14960	100.000	100.007	100.014	100.021	100.028	100.035	100.042	100.049	100.056	100.063
14970	100.069	100.076	100.083	100.090	100.097	100.104	100.111	100.118	100.125	100.132
14980	100.139	100.146	100.153	100.160	100.167	100.174	100.181	100.188	100.194	100.201
14990	100.208	100.215	100.222	100.229	100.236	100.243	100.250	100.257	100.264	100.271
15000	100.278	100.285	100.292	100.299	100.306	100.313	100.319	100.326	100.333	100.340
15010	100.347	100.354	100.361	100.368	100.375	100.382	100.389	100.396	100.403	100.410
15020	100.417	100.424	100.431	100.438	100.444	100.451	100.458	100.465	100.472	100.479
15030	100.486	100.493	100.500	100.507	100.514	100.521	100.528	100.535	100.542	100.549
15040	100.556	100.563	100.569	100.576	100.583	100.590	100.597	100.604	100.611	100.618
15050	100.625	100.632	100.639	100.646	95.355	95.362	95.368	95.375	95.382	95.388
15060	95.395	95.401	95.408	95.414	95.421	95.428	95.434	95.441	95.447	95.454
15070	95.461	95.467	95.474	95.480	95.487	95.493	95.500	95.507	95.513	95.520
15080	95.526	95.533	95.539	95.546	95.553	95.559	95.566	95.572	95.579	95.586
15090	95.592	95.599	95.605	95.612	95.618	95.625	95.632	95.638	95.645	95.651
15100	95.658	95.664	95.671	95.678	95.684	95.691	95.697	95.704	95.711	95.717
15110	95.724	95.730	95.737	95.743	95.750	95.757	95.763	95.770	95.776	95.783
15120	95.789	95.796	95.803	95.809	95.816	95.822	95.829	95.836	95.842	95.849
15130	95.855	95.862	95.868	95.875	95.882	95.888	95.895	95.901	95.908	95.914
15140	95.921	95.928	95.934	95.941	95.947	95.954	95.961	95.967	95.974	95.980
15150	95.987	95.993	96.000	96.007	96.013	96.020	96.026	96.033	96.039	96.046
15160	96.053	96.059	96.066	96.072	96.079	96.086	96.092	96.099	96.105	96.112
15170	96.118	96.125	96.132	96.138	96.145	96.151	96.158	96.164	96.171	96.178
15180	96.184	96.191	96.197	96.204	96.211	96.217	96.224	96.230	96.237	96.243
15190	96.250	96.257	96.263	96.270	96.276	96.283	96.289	96.296	96.303	96.309
15200	96.316	96.322	96.329	96.336	96.342	96.349	96.355	96.362	96.368	96.375
15210	96.382	96.388	96.395	96.401	96.408	96.414	96.421	96.428	96.434	96.441
15220	96.447	96.454	96.461	96.467	96.474	96.480	96.487	96.493	96.500	96.507
15230	96.513	96.520	96.526	96.533	96.539	96.546	96.553	96.559	96.566	96.572
15240	96.579	96.586	96.592	96.599	96.605	96.612	96.618	96.625	96.632	96.638
15250	96.645	96.651	96.658	96.664	96.671	96.678	96.684	96.691	96.697	96.704
15260	96.711	96.717	96.724	96.730	96.737	96.743	96.750	96.757	96.763	96.770
15270	96.776	96.783	96.789	96.796	96.803	96.809	96.816	96.822	96.829	96.836
15280	96.842	96.849	96.855	96.862	96.868	96.875	96.882	96.888	96.895	96.901
15290	96.908	96.914	96.921	96.928	96.934	96.941	96.947	96.954	96.961	96.967

SYNTHESIZER FREQUENCIES, TCM-609

	0	1	2	3	4	5	6	7	8	9
17700	99.825	99.830	99.836	99.842	99.848	99.854	99.860	99.866	99.871	99.877
17710	99.883	99.889	99.895	99.901	99.906	99.912	99.918	99.924	99.930	99.936
17720	99.942	99.947	99.953	99.959	99.965	99.971	99.977	99.982	99.988	99.994
17730	100.000	100.006	100.012	100.018	100.023	100.029	100.035	100.041	100.047	100.053
17740	100.058	100.064	100.070	100.076	100.082	100.088	100.094	100.099	100.105	100.111
17750	100.117	100.123	100.129	100.135	100.140	100.146	100.152	100.158	100.164	100.170
17760	100.175	100.181	100.187	100.193	100.199	100.205	100.211	100.216	100.222	100.228
17770	100.234	100.240	100.246	100.251	100.257	100.263	100.269	100.275	100.281	100.287
17780	100.292	100.298	100.304	100.310	100.316	100.322	100.327	100.333	100.339	100.345
17790	100.351	100.357	100.363	100.368	100.374	100.380	100.386	100.392	100.398	100.404
17800	100.409	100.415	100.421	100.427	100.433	100.439	100.444	100.450	100.456	100.462
17810	100.468	100.474	100.480	100.485	100.491	100.497	100.503	100.509	95.489	95.494
17820	95.500	95.506	95.511	95.517	95.522	95.528	95.533	95.539	95.544	95.550
17830	95.556	95.561	95.567	95.572	95.578	95.583	95.589	95.594	95.600	95.606
17840	95.611	95.617	95.622	95.628	95.633	95.639	95.644	95.650	95.656	95.661
17850	95.667	95.672	95.678	95.683	95.689	95.694	95.700	95.706	95.711	95.717
17860	95.722	95.728	95.733	95.739	95.744	95.750	95.756	95.761	95.767	95.772
17870	95.778	95.783	95.789	95.794	95.800	95.806	95.811	95.817	95.822	95.828
17880	95.833	95.839	95.844	95.850	95.856	95.861	95.867	95.872	95.878	95.883
17890	95.889	95.894	95.900	95.906	95.911	95.917	95.922	95.928	95.933	95.939
17900	95.944	95.950	95.956	95.961	95.967	95.972	95.978	95.983	95.989	95.994
17910	96.000	96.006	96.011	96.017	96.022	96.028	96.033	96.039	96.044	96.050
17920	96.056	96.061	96.067	96.072	96.078	96.083	96.089	96.094	96.100	96.106
17930	96.111	96.117	96.122	96.128	96.133	96.139	96.144	96.150	96.156	96.161
17940	96.167	96.172	96.178	96.183	96.189	96.194	96.200	96.206	96.211	96.217
17950	96.222	96.228	96.233	96.239	96.244	96.250	96.256	96.261	96.267	96.272
17960	96.278	96.283	96.289	96.294	96.300	96.306	96.311	96.317	96.322	96.328
17970	96.333	96.339	96.344	96.350	96.356	96.361	96.367	96.372	96.378	96.383
17980	96.389	96.394	96.400	96.406	96.411	96.417	96.422	96.428	96.433	96.439
17990	96.444	96.450	96.456	96.461	96.467	96.472	96.478	96.483	96.489	96.494
18000	96.500	96.506	96.511	96.517	96.522	96.528	96.533	96.539	96.544	96.550
18010	96.556	96.561	96.567	96.572	96.578	96.583	96.589	96.594	96.600	96.606
18020	96.611	96.617	96.622	96.628	96.633	96.639	96.644	96.650	96.656	96.661
18030	96.667	96.672	96.678	96.683	96.689	96.694	96.700	96.706	96.711	96.717
18040	96.722	96.728	96.733	96.739	96.744	96.750	96.756	96.761	96.767	96.772
18050	96.778	96.783	96.789	96.794	96.800	96.806	96.811	96.817	96.822	96.828
18060	96.833	96.839	96.844	96.850	96.856	96.861	96.867	96.872	96.878	96.883
18070	96.889	96.894	96.900	96.906	96.911	96.917	96.922	96.928	96.933	96.939
18080	96.944	96.950	96.956	96.961	96.967	96.972	96.978	96.983	96.989	96.994
18090	97.000	97.006	97.011	97.017	97.022	97.028	97.033	97.039	97.044	97.050
18100	97.056	97.061	97.067	97.072	97.078	97.083	97.089	97.094	97.100	97.106
18110	97.111	97.117	97.122	97.128	97.133	97.139	97.144	97.150	97.156	97.161
18120	97.167	97.172	97.178	97.183	97.189	97.194	97.200	97.206	97.211	97.217
18130	97.222	97.228	97.233	97.239	97.244	97.250	97.256	97.261	97.267	97.272
18140	97.278	97.283	97.289	97.294	97.300	97.306	97.311	97.317	97.322	97.328
18150	97.333	97.339	97.344	97.350	97.356	97.361	97.367	97.372	97.378	97.383
18160	97.389	97.394	97.400	97.406	97.411	97.417	97.422	97.428	97.433	97.439
18170	97.444	97.450	97.456	97.461	97.467	97.472	97.478	97.483	97.489	97.494
18180	97.500	97.506	97.511	97.517	97.522	97.528	97.533	97.539	97.544	97.550
18190	97.556	97.561	97.567	97.572	97.578	97.583	97.589	97.594	97.600	97.606

	0	1	2	3	4	5	6	7	8	9
18200	97.611	97.617	97.622	97.628	97.633	97.639	97.644	97.650	97.656	97.661
18210	97.667	97.672	97.678	97.683	97.689	97.694	97.700	97.706	97.711	97.717
18220	97.722	97.728	97.733	97.739	97.744	97.750	97.756	97.761	97.767	97.772
18230	97.778	97.783	97.789	97.794	97.800	97.806	97.811	97.817	97.822	97.828
18240	97.833	97.839	97.844	97.850	97.856	97.861	97.867	97.872	97.878	97.883
18250	97.889	97.894	97.900	97.906	97.911	97.917	97.922	97.928	97.933	97.939
18260	97.944	97.950	97.956	97.961	97.967	97.972	97.978	97.983	97.989	97.994
18270	98.000	98.006	98.011	98.017	98.022	98.028	98.033	98.039	98.044	98.050
18280	98.056	98.061	98.067	98.072	98.078	98.083	98.089	98.094	98.100	98.106
18290	98.111	98.117	98.122	98.128	98.133	98.139	98.144	98.150	98.156	98.161
18300	98.167	98.172	98.178	98.183	98.189	98.194	98.200	98.206	98.211	98.217
18310	98.222	98.228	98.233	98.239	98.244	98.250	98.256	98.261	98.267	98.272
18320	98.278	98.283	98.289	98.294	98.300	98.306	98.311	98.317	98.322	98.328
18330	98.333	98.339	98.344	98.350	98.356	98.361	98.367	98.372	98.378	98.383
18340	98.389	98.394	98.400	98.406	98.411	98.417	98.422	98.428	98.433	98.439
18350	98.444	98.450	98.456	98.461	98.467	98.472	98.478	98.483	98.489	98.494
18360	98.500	98.506	98.511	98.517	98.522	98.528	98.533	98.539	98.544	98.550
18370	98.556	98.561	98.567	98.572	98.578	98.583	98.589	98.594	98.600	98.606
18380	98.611	98.617	98.622	98.628	98.633	98.639	98.644	98.650	98.656	98.661
18390	98.667	98.672	98.678	98.683	98.689	98.694	98.700	98.706	98.711	98.717
18400	98.722	98.728	98.733	98.739	98.744	98.750	98.756	98.761	98.767	98.772
18410	98.778	98.783	98.789	98.794	98.800	98.806	98.811	98.817	98.822	98.828
18420	98.833	98.839	98.844	98.850	98.856	98.861	98.867	98.872	98.878	98.883
18430	98.889	98.894	98.900	98.906	98.911	98.917	98.922	98.928	98.933	98.939
18440	98.944	98.950	98.956	98.961	98.967	98.972	98.978	98.983	98.989	98.994
18450	99.000	99.006	99.011	99.017	99.022	99.028	99.033	99.039	99.044	99.050
18460	99.056	99.061	99.067	99.072	99.078	99.083	99.089	99.094	99.100	99.106
18470	99.111	99.117	99.122	99.128	99.133	99.139	99.144	99.150	99.156	99.161
18480	99.167	99.172	99.178	99.183	99.189	99.194	99.200	99.206	99.211	99.217
18490	99.222	99.228	99.233	99.239	99.244	99.250	99.256	99.261	99.267	99.272
18500	99.278	99.283	99.289	99.294	99.300	99.306	99.311	99.317	99.322	99.328
18510	99.333	99.339	99.344	99.350	99.356	99.361	99.367	99.372	99.378	99.383
18520	99.389	99.394	99.400	99.406	99.411	99.417	99.422	99.428	99.433	99.439
18530	99.444	99.450	99.456	99.461	99.467	99.472	99.478	99.483	99.489	99.494
18540	99.500	99.506	99.511	99.517	99.522	99.528	99.533	99.539	99.544	99.550
18550	99.556	99.561	99.567	99.572	99.578	99.583	99.589	99.594	99.600	99.606
18560	99.611	99.617	99.622	99.628	99.633	99.639	99.644	99.650	99.656	99.661
18570	99.667	99.672	99.678	99.683	99.689	99.694	99.700	99.706	99.711	99.717
18580	99.722	99.728	99.733	99.739	99.744	99.750	99.756	99.761	99.767	99.772
18590	99.778	99.783	99.789	99.794	99.800	99.806	99.811	99.817	99.822	99.828
18600	99.833	99.839	99.844	99.850	99.856	99.861	99.867	99.872	99.878	99.883
18610	99.889	99.894	99.900	99.906	99.911	99.917	99.922	99.928	99.933	99.939
18620	99.944	99.950	99.956	99.961	99.967	99.972	99.978	99.983	99.989	99.994
18630	100.000	100.006	100.011	100.017	100.022	100.028	100.033	100.039	100.044	100.050
18640	100.056	100.061	100.067	100.072	100.078	100.083	100.089	100.094	100.100	100.106
18650	100.111	100.117	100.122	100.128	100.133	100.139	100.144	100.150	100.156	100.161
18660	100.167	100.172	100.178	100.183	100.189	100.194	100.200	100.206	100.211	100.217
18670	100.222	100.228	100.233	100.239	100.244	100.250	100.256	100.261	100.267	100.272
18680	100.278	100.283	100.289	100.294	100.300	100.306	100.311	100.317	100.322	100.328
18690	100.333	100.339	100.344	100.350	100.356	100.361	100.367	100.372	100.378	100.383

SYNTHESIZER FREQUENCIES, TCM-609

	0	1	2	3	4	5	6	7	8	9
18700	100.389	95.614	95.619	95.624	95.630	95.635	95.640	95.646	95.651	95.656
18710	95.661	95.667	95.672	95.677	95.683	95.688	95.693	95.698	95.704	95.709
18720	95.714	95.720	95.725	95.730	95.735	95.741	95.746	95.751	95.757	95.762
18730	95.767	95.772	95.778	95.783	95.788	95.794	95.799	95.804	95.810	95.815
18740	95.820	95.825	95.831	95.836	95.841	95.847	95.852	95.857	95.862	95.868
18750	95.873	95.878	95.884	95.889	95.894	95.899	95.905	95.910	95.915	95.921
18760	95.926	95.931	95.937	95.942	95.947	95.952	95.958	95.963	95.968	95.974
18770	95.979	95.984	95.989	95.995	96.000	96.005	96.011	96.016	96.021	96.026
18780	96.032	96.037	96.042	96.048	96.053	96.058	96.064	96.069	96.074	96.079
18790	96.085	96.090	96.095	96.101	96.106	96.111	96.116	96.122	96.127	96.132
18800	96.138	96.143	96.148	96.153	96.159	96.164	96.169	96.175	96.180	96.185
18810	96.190	96.196	96.201	96.206	96.212	96.217	96.222	96.228	96.233	96.238
18820	96.243	96.249	96.254	96.259	96.265	96.270	96.275	96.280	96.286	96.291
18830	96.296	96.302	96.307	96.312	96.317	96.323	96.328	96.333	96.339	96.344
18840	96.349	96.354	96.360	96.365	96.370	96.376	96.381	96.386	96.392	96.397
18850	96.402	96.407	96.413	96.418	96.423	96.429	96.434	96.439	96.444	96.450
18860	96.455	96.460	96.466	96.471	96.476	96.481	96.487	96.492	96.497	96.503
18870	96.508	96.513	96.519	96.524	96.529	96.534	96.540	96.545	96.550	96.556
18880	96.561	96.566	96.571	96.577	96.582	96.587	96.593	96.598	96.603	96.608
18890	96.614	96.619	96.624	96.630	96.635	96.640	96.646	96.651	96.656	96.661
18900	96.667	96.672	96.677	96.683	96.688	96.693	96.698	96.704	96.709	96.714
18910	96.720	96.725	96.730	96.735	96.741	96.746	96.751	96.757	96.762	96.767
18920	96.772	96.778	96.783	96.788	96.794	96.799	96.804	96.810	96.815	96.820
18930	96.825	96.831	96.836	96.841	96.847	96.852	96.857	96.862	96.868	96.873
18940	96.878	96.884	96.889	96.894	96.899	96.905	96.910	96.915	96.921	96.926
18950	96.931	96.937	96.942	96.947	96.952	96.958	96.963	96.968	96.974	96.979
18960	96.984	96.989	96.995	97.000	97.005	97.011	97.016	97.021	97.026	97.032
18970	97.037	97.042	97.048	97.053	97.058	97.064	97.069	97.074	97.079	97.085
18980	97.090	97.095	97.101	97.106	97.111	97.116	97.122	97.127	97.132	97.138
18990	97.143	97.148	97.153	97.159	97.164	97.169	97.175	97.180	97.185	97.190
19000	97.196	97.201	97.206	97.212	97.217	97.222	97.228	97.233	97.238	97.243
19010	97.249	97.254	97.259	97.265	97.270	97.275	97.280	97.286	97.291	97.296
19020	97.302	97.307	97.312	97.317	97.323	97.328	97.333	97.339	97.344	97.349
19030	97.354	97.360	97.365	97.370	97.376	97.381	97.386	97.392	97.397	97.402
19040	97.407	97.413	97.418	97.423	97.429	97.434	97.439	97.444	97.450	97.455
19050	97.460	97.466	97.471	97.476	97.481	97.487	97.492	97.497	97.503	97.508
19060	97.513	97.519	97.524	97.529	97.534	97.540	97.545	97.550	97.556	97.561
19070	97.566	97.571	97.577	97.582	97.587	97.593	97.598	97.603	97.608	97.614
19080	97.619	97.624	97.630	97.635	97.640	97.646	97.651	97.656	97.661	97.667
19090	97.672	97.677	97.683	97.688	97.693	97.698	97.704	97.709	97.714	97.720
19100	97.725	97.730	97.735	97.741	97.746	97.751	97.757	97.762	97.767	97.772
19110	97.778	97.783	97.788	97.794	97.799	97.804	97.810	97.815	97.820	97.825
19120	97.831	97.836	97.841	97.847	97.852	97.857	97.862	97.868	97.873	97.878
19130	97.884	97.889	97.894	97.899	97.905	97.910	97.915	97.921	97.926	97.931
19140	97.937	97.942	97.947	97.952	97.958	97.963	97.968	97.974	97.979	97.984
19150	97.989	97.995	98.000	98.005	98.011	98.016	98.021	98.026	98.032	98.037
19160	98.042	98.048	98.053	98.058	98.064	98.069	98.074	98.079	98.085	98.090
19170	98.095	98.101	98.106	98.111	98.116	98.122	98.127	98.132	98.138	98.143
19180	98.148	98.153	98.159	98.164	98.169	98.175	98.180	98.185	98.190	98.196
19190	98.201	98.206	98.212	98.217	98.222	98.228	98.233	98.238	98.243	98.249

	0	1	2	3	4	5	6	7	8	9
19200	98.254	98.259	98.265	98.270	98.275	98.280	98.286	98.291	98.296	98.302
19210	98.307	98.312	98.317	98.323	98.328	98.333	98.339	98.344	98.349	98.354
19220	98.360	98.365	98.370	98.376	98.381	98.386	98.392	98.397	98.402	98.407
19230	98.413	98.418	98.423	98.429	98.434	98.439	98.444	98.450	98.455	98.460
19240	98.466	98.471	98.476	98.481	98.487	98.492	98.497	98.503	98.508	98.513
19250	98.519	98.524	98.529	98.534	98.540	98.545	98.550	98.556	98.561	98.566
19260	98.571	98.577	98.582	98.587	98.593	98.598	98.603	98.608	98.614	98.619
19270	98.624	98.630	98.635	98.640	98.646	98.651	98.656	98.661	98.667	98.672
19280	98.677	98.683	98.688	98.693	98.698	98.704	98.709	98.714	98.720	98.725
19290	98.730	98.735	98.741	98.746	98.751	98.757	98.762	98.767	98.772	98.778
19300	98.783	98.788	98.794	98.799	98.804	98.810	98.815	98.820	98.825	98.831
19310	98.836	98.841	98.847	98.852	98.857	98.862	98.868	98.873	98.878	98.884
19320	98.889	98.894	98.899	98.905	98.910	98.915	98.921	98.926	98.931	98.937
19330	98.942	98.947	98.952	98.958	98.963	98.968	98.974	98.979	98.984	98.989
19340	98.995	99.000	99.005	99.011	99.016	99.021	99.026	99.032	99.037	99.042
19350	99.048	99.053	99.058	99.064	99.069	99.074	99.079	99.085	99.090	99.095
19360	99.101	99.106	99.111	99.116	99.122	99.127	99.132	99.138	99.143	99.148
19370	99.153	99.159	99.164	99.169	99.175	99.180	99.185	99.190	99.196	99.201
19380	99.206	99.212	99.217	99.222	99.228	99.233	99.238	99.243	99.249	99.254
19390	99.259	99.265	99.270	99.275	99.280	99.286	99.291	99.296	99.302	99.307
19400	99.312	99.317	99.323	99.328	99.333	99.339	99.344	99.349	99.354	99.360
19410	99.365	99.370	99.376	99.381	99.386	99.392	99.397	99.402	99.407	99.413
19420	99.418	99.423	99.429	99.434	99.439	99.444	99.450	99.455	99.460	99.466
19430	99.471	99.476	99.481	99.487	99.492	99.497	99.503	99.508	99.513	99.519
19440	99.524	99.529	99.534	99.540	99.545	99.550	99.556	99.561	99.566	99.571
19450	99.577	99.582	99.587	99.593	99.598	99.603	99.608	99.614	99.619	99.624
19460	99.630	99.635	99.640	99.646	99.651	99.656	99.661	99.667	99.672	99.677
19470	99.683	99.688	99.693	99.698	99.704	99.709	99.714	99.720	99.725	99.730
19480	99.735	99.741	99.746	99.751	99.757	99.762	99.767	99.772	99.778	99.783
19490	99.788	99.794	99.799	99.804	99.810	99.815	99.820	99.825	99.831	99.836
19500	99.841	99.847	99.852	99.857	99.862	99.868	99.873	99.878	99.884	99.889
19510	99.894	99.899	99.905	99.910	99.915	99.921	99.926	99.931	99.937	99.942
19520	99.947	99.952	99.958	99.963	99.968	99.974	99.979	99.984	99.989	99.995
19530	100.000	100.005	100.011	100.016	100.021	100.026	100.032	100.037	100.042	100.048
19540	100.053	100.058	100.064	100.069	100.074	100.079	100.085	100.090	100.095	100.101
19550	100.106	100.111	100.116	100.122	100.127	100.132	100.138	100.143	100.148	100.153
19560	100.159	100.164	100.169	100.175	100.180	100.185	100.190	100.196	100.201	100.206
19570	100.212	100.217	100.222	100.228	100.233	100.238	100.243	100.249	100.254	100.259
19580	100.265	100.270	100.275	95.722	95.727	95.732	95.737	95.742	95.747	95.753
19590	95.758	95.763	95.768	95.773	95.778	95.783	95.788	95.793	95.798	95.803
19600	95.808	95.813	95.818	95.823	95.828	95.833	95.838	95.843	95.848	95.854
19610	95.859	95.864	95.869	95.874	95.879	95.884	95.889	95.894	95.899	95.904
19620	95.909	95.914	95.919	95.924	95.929	95.934	95.939	95.944	95.949	95.955
19630	95.960	95.965	95.970	95.975	95.980	95.985	95.990	95.995	96.000	96.005
19640	96.010	96.015	96.020	96.025	96.030	96.035	96.040	96.045	96.051	96.056
19650	96.061	96.066	96.071	96.076	96.081	96.086	96.091	96.096	96.101	96.106
19660	96.111	96.116	96.121	96.126	96.131	96.136	96.141	96.146	96.152	96.157
19670	96.162	96.167	96.172	96.177	96.182	96.187	96.192	96.197	96.202	96.207
19680	96.212	96.217	96.222	96.227	96.232	96.237	96.242	96.247	96.253	96.258
19690	96.263	96.268	96.273	96.278	96.283	96.288	96.293	96.298	96.303	96.308

PRODUCT DESCRIPTION
TERRACOM MODEL TCM-610
DIGITAL RADIO

A Modification Of The TCM-600 For Digital Data Use

The TCM-600 Series microwave radio typically uses an analog voltage input to frequency modulate the transmitter. In the receiver, a discriminator detects this FM signal and converts it back into a replica of the original signal with as little distortion and noise as possible. The TCM-600 is converted into a hybrid radio by replacing the analog baseband modules in the transmitter and receiver with digital baseband modules. With this change, the radio is designated the TCM-610 Series. The TCM-610 accepts digital data input and produces a form of FM modulation known as "biternary FM" or "partial response."

Definition of Digital Terms

To begin the discussion of a digital radio a brief definition of some of the terms used must be made.

"Bits Per Hertz" Efficiency

The expression "bits per Hertz" is used by the FCC to define the bandwidth efficiency with which a radio will be required to transmit data in a particular band. In a "one bit per Hertz band, 10 Mb/s will be allowed 10 MHz of RF bandwidth. In a two bit per Hertz band, the same 10 Mb/s will be allowed only 5 MHz of RF bandwidth. This requirement may also be expressed in terms of the number of voice channels which must be transmitted. For example, in the 11 GHz band, 40 MHz bandwidths requiring transmission of 1152 voice channels have been allocated. Using a standard 64 kb/s PCM multiplexer, this requires 73.8 Mb/s (64 kb/s x 1152) or slightly less than two bits per Hertz.

"Digital Data" Formats

When the expression "digital data" is used, it can imply many forms. Two common forms are Non-Return to Zero (NRZ) and Return to Zero (RZ). The most common is NRZ. Both are illustrated in Figure 1.

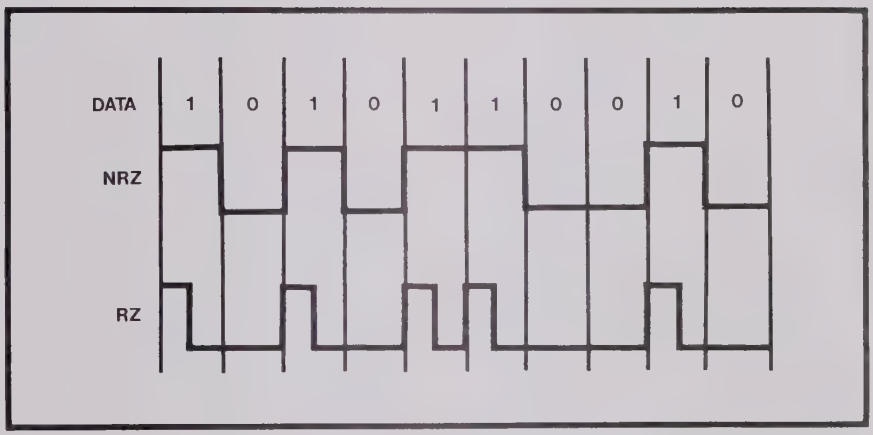

Figure 1 NRZ and RZ Data Formats

As can be seen, the RZ data pattern always has a DC component. Similarly, if there is a long string of zeros or ones in the NRZ pattern, the RMS value of the signal would not fall in the middle (i.e., at 0 volts) and there would be a resultant DC component. This type of signal has the disadvantage of being difficult to transmit on cables because cable amplifiers would have to be DC coupled.

Another commonly used type of data transmission favored by Bell is Alternate Mark Inversion (AMI) or "bipolar" as illustrated in Figure 2.

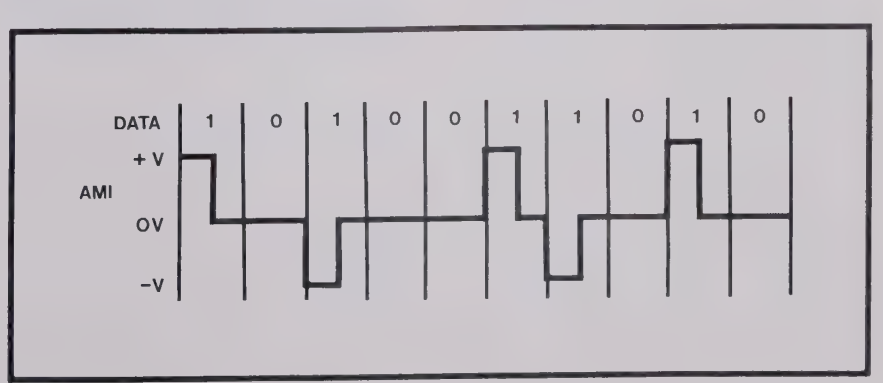

Figure 2 AMI Data Format

With the AMI data format, ones alternate between a plus voltage and minus voltage while zero remains at zero volts DC. Since this type of signal has a zero volt DC component independent of data pattern, it has the particular advantage of being easy to AC couple and send down long runs of cable.

"T1, T2, T3" Data

In addition to the above, industry-wide data formats have been adopted from Bell System expressions such as T1, T2 and T3. These are specific formats generated by Bell for data handling in their equipment. T1 is a data rate of 1.544 Mb/s and has the capacity of 24 PCM voice or 64 kb/s data channels. T2 is 6.312 Mb/s and is composed of either 4 T1's (96 voice channels) or a picture phone. T3 is 44.736 Mb/s and is composed of either 7 T2's or 28 T1's (672 voice channels).*

All data generated at 6.312 Mb/s may not be T2, since at this level Bell specifies a particular data format known as B6ZS. B6ZS is a type of coding that replaces six consecutive zeros with a special code which includes bipolar violations. In this manner, if there were a long chain of zeros, there would be artificial activity on the line to facilitate timing recovery at the receive end. The figure at the end of the discussion is a comparison of various types of data formats.

Although there are a large variety of data formats, one simple point should be understood: data is nothing but a series of "ones and zeros," on-offs, open circuits-closed circuits, etc., to represent information. The quality of a transmitted signal does not depend on how the information gets from zero to one or back but, instead, on the results of the receive-end decision circuit which decides the state.

"Biternary" FM

The concept of "biternary" FM or three level partial response has been around for some time. It produces a spectrum of one bit per Hertz. As a comparison with straight frequency modulation, consider a continuous stream of ones and zeros at a 10 Mb/s rate. With standard FM, the modulation pattern — which could be considered as a 5 MHz squarewave — would at any deviation result in an RF spectrum well in excess of 10 MHz. With biternary FM, a Gaussian filter is used to pre-shape the data at approximately one-quarter the data rate, as shown in Figure 3.

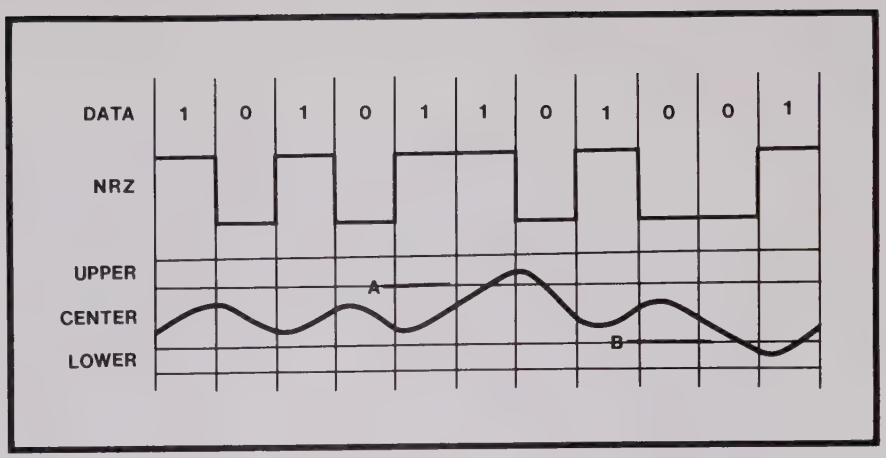

Figure 3 Gaussian Filtered Waveform

Notice that the response of the filter produces an analog signal that has three distinct regions. When this waveform is passed through the discriminator in the receiver, slicers with DC levels set equal to points A and B can logically regenerate the original signal. This transmitter signal is a smooth waveform and, therefore, not rich in harmonics. When the transmitter peak deviation is set to about one-half the data rate, this filtered modulation signal produces a spectrum that is almost rectangular in shape and inside the necessary bandwidth requirements. The resultant RF spectrum is shown in Figure 4.

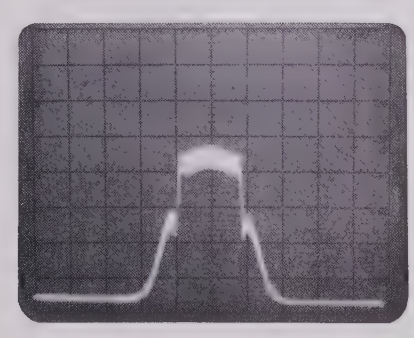

Figure 4 Biternary FM Spectrum

Advantages Of Digital Radios

There are some definite advantages to digital radios. If in an analog system, the first hop were to add distortion or noise to degrade the S/N, no additional hops could ever improve that S/N. In a digital system, so long as there is sufficient S/N to regenerate the data accurately, the output of a receiver is clean data. The output of the 30th hop looks like the output of the first. Digital radios will fade with no noticeable performance change until close to threshold, but when the S/N approaches threshold the system will crash in 3 dB. At this signal level, however, the output of an analog signal would also have become useless due to noise. Most analog signals are considered bad when their S/N gets worse than 30 dB. Most digital units will continue to regenerate correctly at S/N ratios of 15 dB.

TCM-610 Description

The hybrid TCM-610 is a one bit per Hertz radio capable of about 13 Mb/s. The electronics necessary to convert the TCM-600 to a TCM-610 for data transmission are contained entirely within the two digital baseband modules. The following is a technical description of these modules.

Transmitter

Consider the block diagram of the transmitter unit illustrated in Figure 5. As discussed above, the data presented by a customer can be in any form. Therefore, it is first converted to a standardized form or radio language compatible with the rest of the logic in the module. This is done on a PC board that will obviously be different for different input formats. The standardized

*Although the FCC bandwidth efficiency requirement is given as 1152 voice channels, U.S. manufacturers generally design their high capacity digital radios to carry 1344 channels (two T3's) in order to be Bell System compatible.

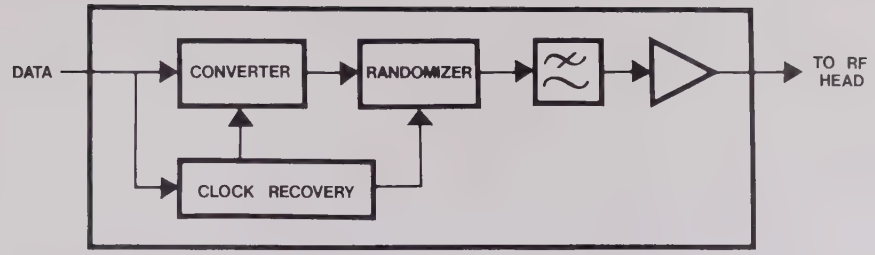

Figure 5 Transmitter Data Baseband Module

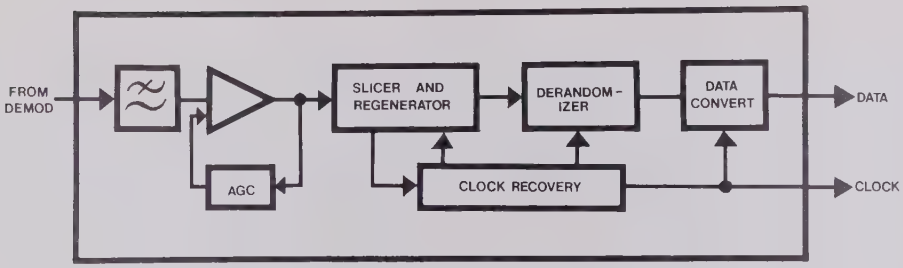

Figure 6 Receiver Data Baseband Module

data format used by the TCM-610 data baseband module is NRZ, or a TTL signal.

Following data conversion is the clock recovery circuit. All logic in a digital system is timed. This means that when a decision is made as to the status of a bit, one or zero, the optimum time to make that decision is in the middle of the bit. Therefore, every digital system must have a timing clock or standard oscillator that is phase-locked to the incoming data. That is the purpose of a clock-recovery. After the data has been processed into the form that the radio will use, it goes through a randomizer. This is required now by the FCC for all digital radios to prevent unmodulated carriers or transmitters with spectral lines due to particular data formats from interfering with adjacent channels. All digital transmitters must "randomize," and to accomplish this we use a simple shift register scrambler. This will guarantee that even if there is no data input, the transmitter spectrum will look symmetrically modulated with white noise. Finally comes the low pass filter and amplifier.

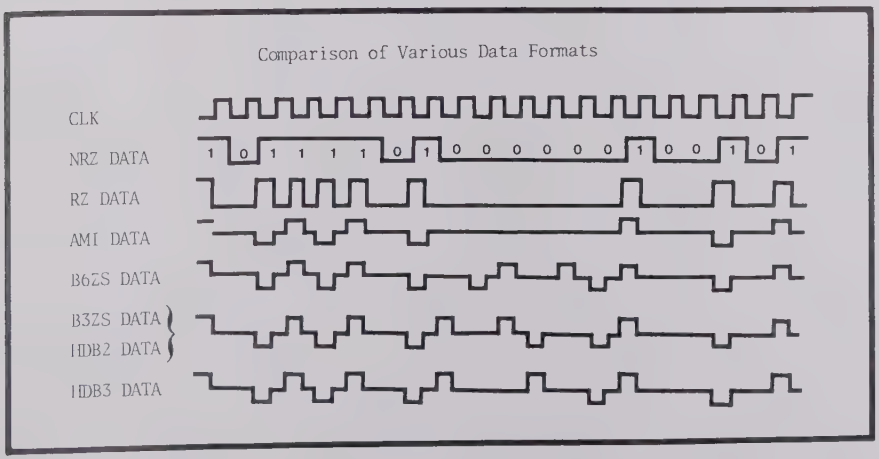
Comparison of Various Data Formats
CLK
NRZ DATA
1 0 1 1 1 1 0 1 0 0 0 0 0 0 1 0 0 1 0 1
RZ DATA
AMI DATA
B6ZS DATA
B3ZS DATA
HDB2 DATA
HDB3 DATA

Figure 7 Comparison of Various Data Formats

Receiver

A digital receiver, as with all radios, is more complex than the transmitter. The receiver data baseband module is shown in Figure 6. The data baseband input comes from a standard FM demodulator. A pair of slicer circuits operating at an absolute DC voltage are critical since their accuracy will determine the threshold of the receiver in the presence of noise. For this reason, an AGC circuit must be used to guarantee the peak-peak voltage reaching these slicers. Using the correct decoding logic, the slicer and regenerator will produce a digital waveform. This digital waveform feeds the clock recovery and phase-locks the master oscillator. The output of the regenerator is retimed to produce the pure NRZ format. Preceding the slicer and amplifier is an identical Gaussian filter as used in the transmitter. Since the filter response exactly matches the shape of the transmitted data, optimum S/N detection against statistical Gaussian noise can be obtained. This is the narrowest filter in the system, setting the S/N at the detector and, hence, determining the receiver threshold.

A derandomizer must follow the regenerator to generate pure data. At this point, a fringe benefit occurs. If the data pattern out of the regenerator is only the scrambled code, then an indicator on the receiver can show that there is no data entering the transmitter at the far end. Finally, a data converter will change the NRZ to the same form as the transmitter input.

The process is done entirely in a set of TCM-610 data modules and requires no changes to existing video or FDM radios that have been shipped. The radios may be operated as a video, FDM, or data system by only changing plug-in modules.

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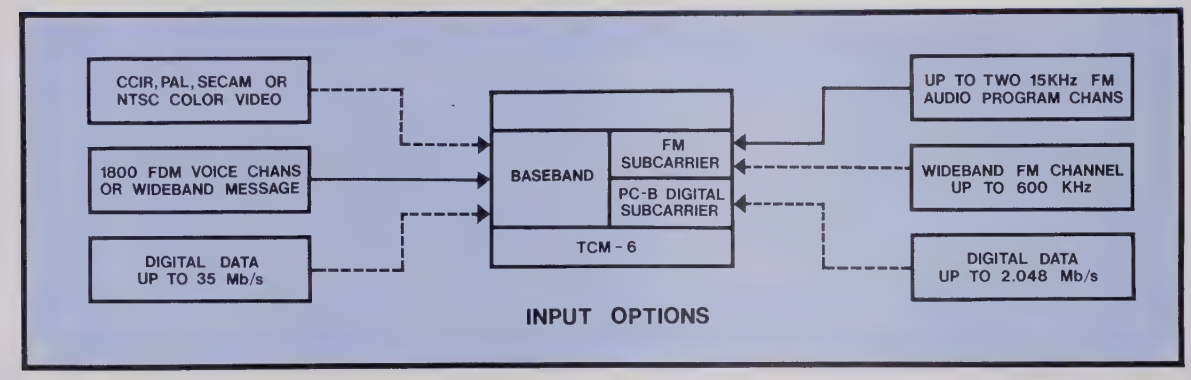
CCIR, PAL, SECAM OR NTSC COLOR VIDEO
1800 FDM VOICE CHANS OR WIDEBAND MESSAGE
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BASEBAND
FM SUBCARRIER
PC-B DIGITAL SUBCARRIER
TCM-6
UP TO TWO 15KHz FM AUDIO PROGRAM CHANS
WIDEBAND FM CHANNEL UP TO 600 KHz
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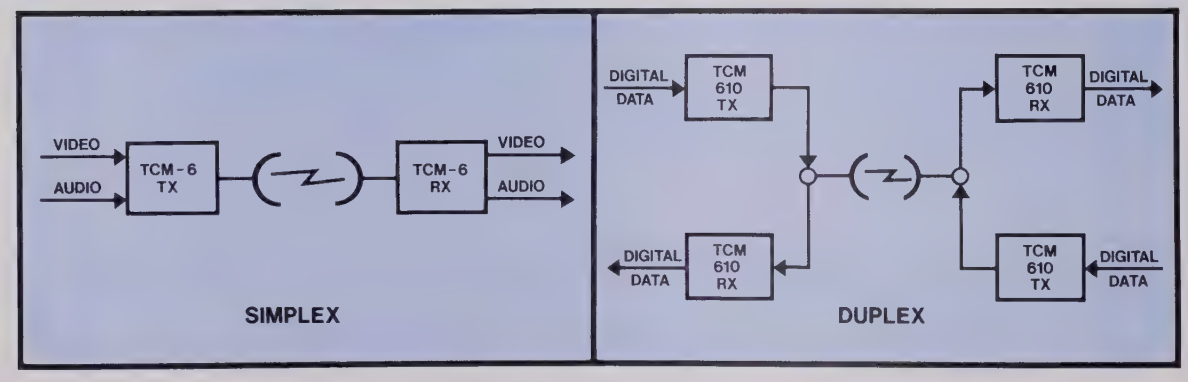
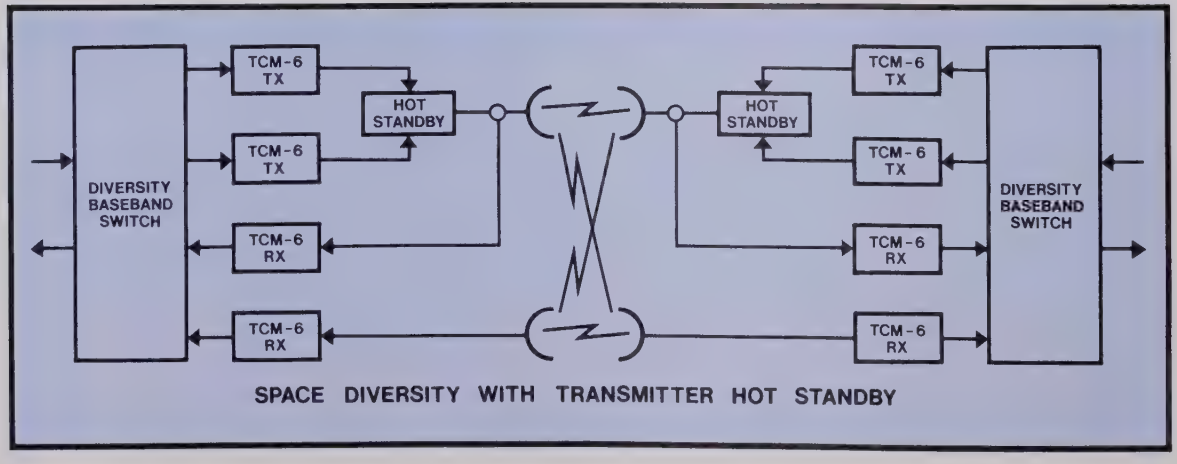
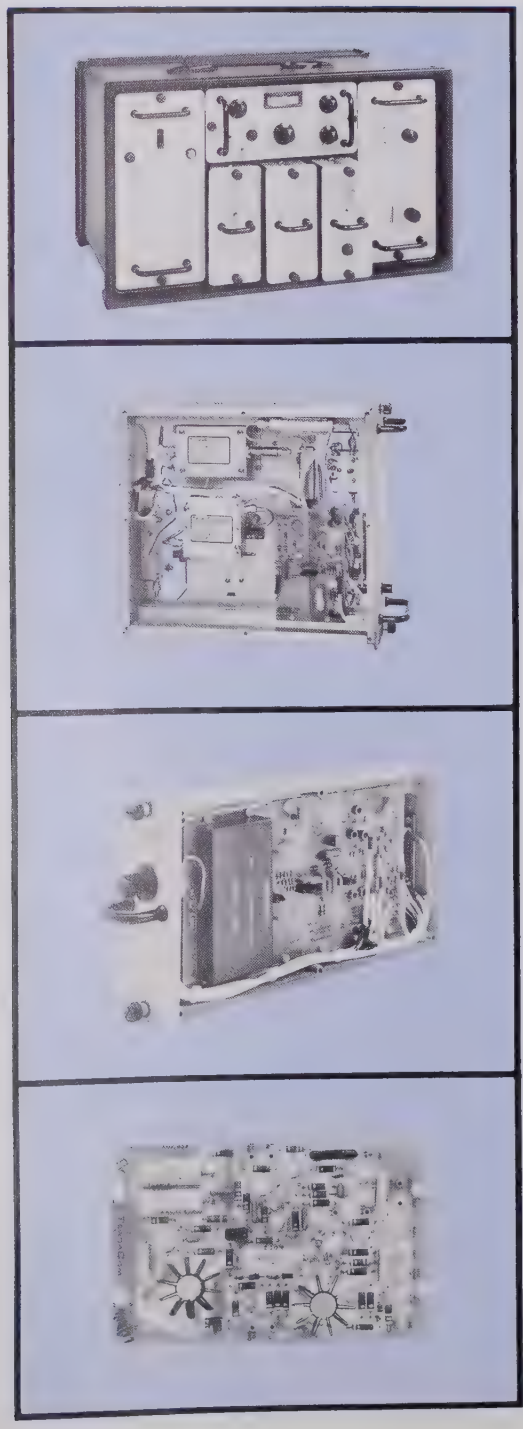
INPUT OPTIONS





Design

- **Proven performance over years of operation in arctic and desert environments**
- **Accepted by major industrial, commercial and military users**



Modularized Construction

Modularized construction and functionally discrete printed circuit boards allow the TCM-6 to be configured to meet individual needs. For example, the standard baseband module can be replaced by a digital module to adapt the radio to carry up to 13 Mb/s digital data.

Each discrete function except for RF processing is performed by an individual printed circuit board. Optional PCB's are available to provide additional functions such as C-Pilot, video clamper, one or two FM subcarrier channels or a wideband digital subcarrier. Captive mounting hardware and U-Link interconnections permit PCB's to be installed and removed without soldering.

Built-in Test Facilities

Built-in test facilities allow the system to be tuned and aligned for the correct FM carrier deviation without additional test equipment. Transmitter test tone and receiver signal strength circuits facilitate antenna alignment and path performance testing.

Any drop in transmitter RF output level below a specified minimum will energize the carrier fault lamp. Additional alarm lights and metering of critical levels provide for easy fault isolation.

Service Channel, Order Wire and Alarms

Ancillary traffic such as service channel, order wire and alarms can be inserted in an unoccupied portion of the baseband or subcarrier channel and transmitted independently of the main traffic flow. Order wires are available with E&M or selective signalling. Alarm stations are available to provide centralized status monitoring and control of remote stations.

9020 Balboa Avenue
San Diego, California 92123
Tel: (714) 278-4100
TWX: TerraCom SDG 910-335-1202
TLX: TerraCom ASDG 18 2774

Loral Microwave Communications

TERRACOM

TERRACOM PRODUCTS

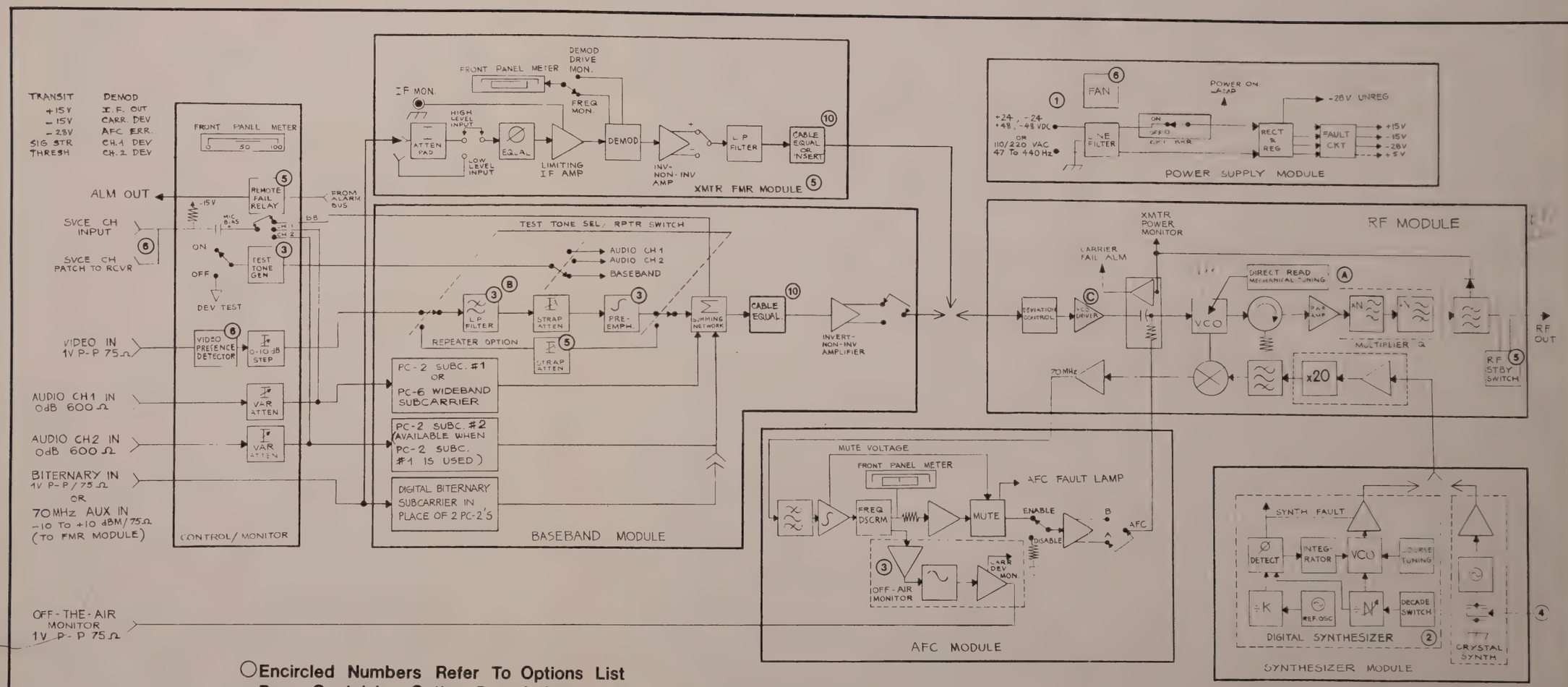
TerraCom equipment is presently in use by the television and telecommunications industries throughout the U.S. and around the world.

MICROWAVE RADIOS
Portable and fixed links, airborne and lightweight for ENG. Hyrbid FM and high capacity PM digital radios.

SATELLITE EARTH STATION RECEIVERS
Fixed tuned, tunable and programmable for instant channel selection.

DIGITAL MULTIPLEX EQUIPMENT
Voice and data channel banks, program channel units, Bell System compatible M12 and M13, CEPT compatible first and second level multiplexers.

MICROWAVE ACCESSORIES
Protection and distribution equipment
Orderwire and alarm systems
Low noise preamplifiers
High power amplifiers
Microwave antennas



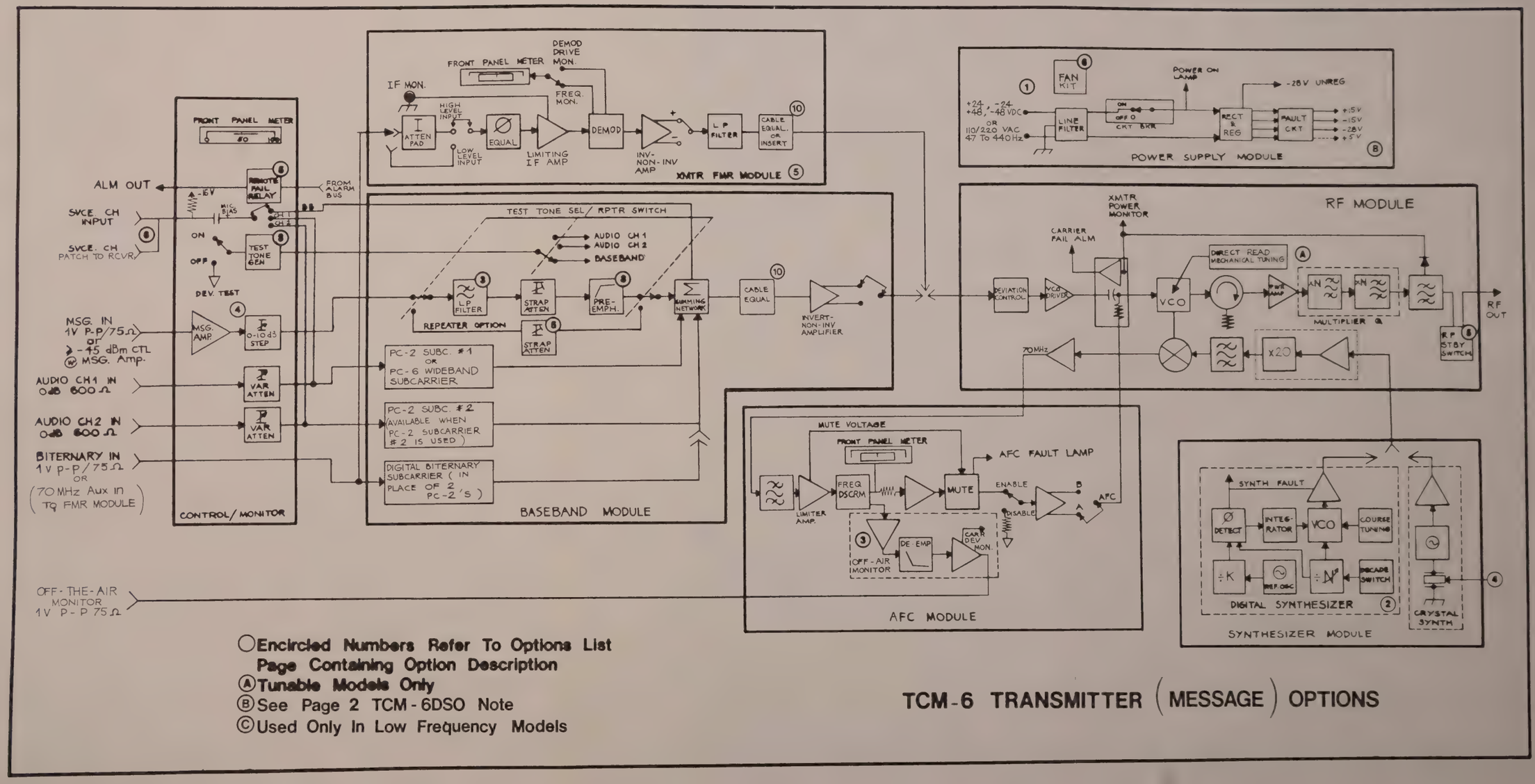
○Encircled Numbers Refer To Options List Page Containing Option Description

Ⓐ Tunable Models Only

Ⓑ Use TCM-6 LPF Low Pass (Butterworth) Filter For NTSC Video
Use TCM-6 VEF Video Elliptical Filter For Pal, SECAM Video

Ⓒ Used Only In Low Frequency Models

TCM-6 TRANSMITTER (VIDEO) OPTIONS



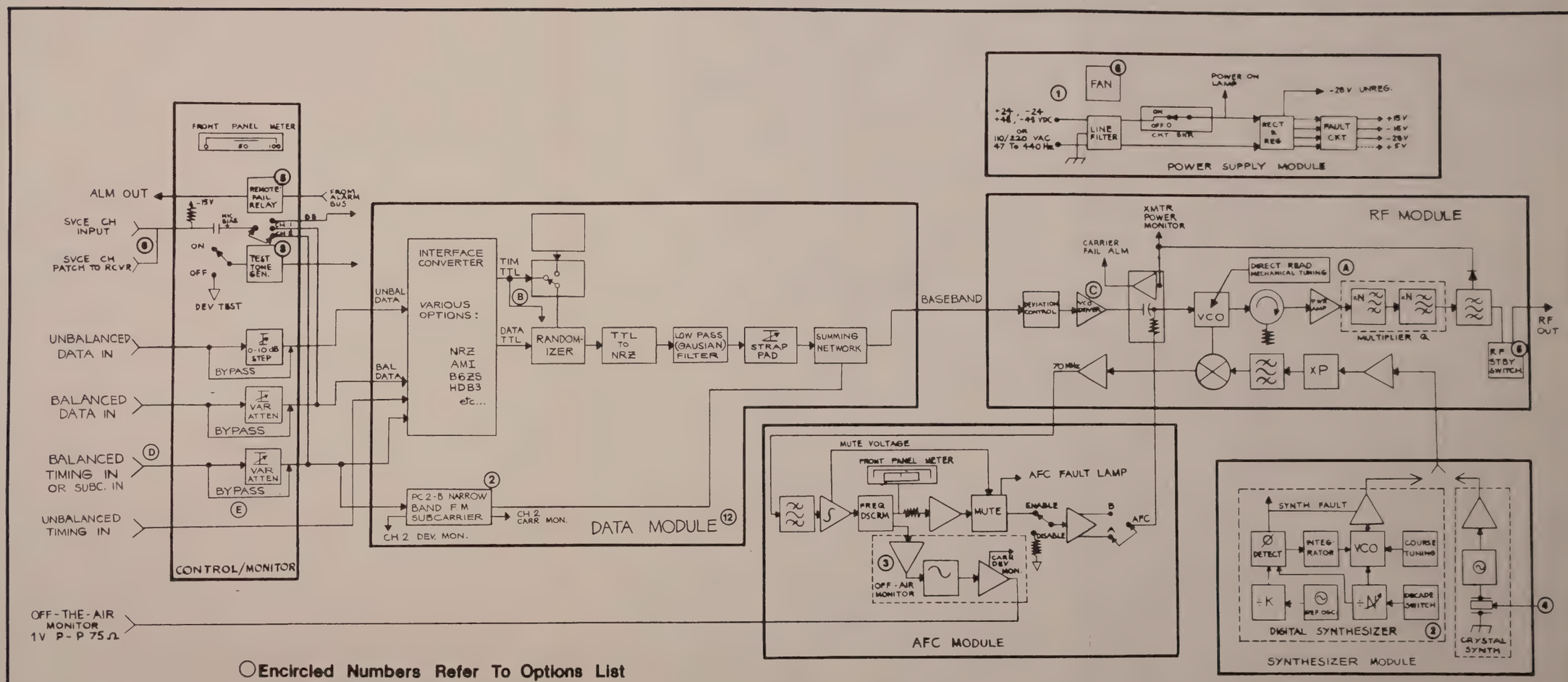
○ Encircled Numbers Refer To Options List Page Containing Option Description

Ⓐ Tunable Models Only

Ⓑ See Page 2 TCM-6DSO Note

Ⓒ Used Only In Low Frequency Models

TCM-6 TRANSMITTER (MESSAGE) OPTIONS



○ Encircled Numbers Refer To Options List Page Containing Option Description

Ⓐ Tunable Models Only

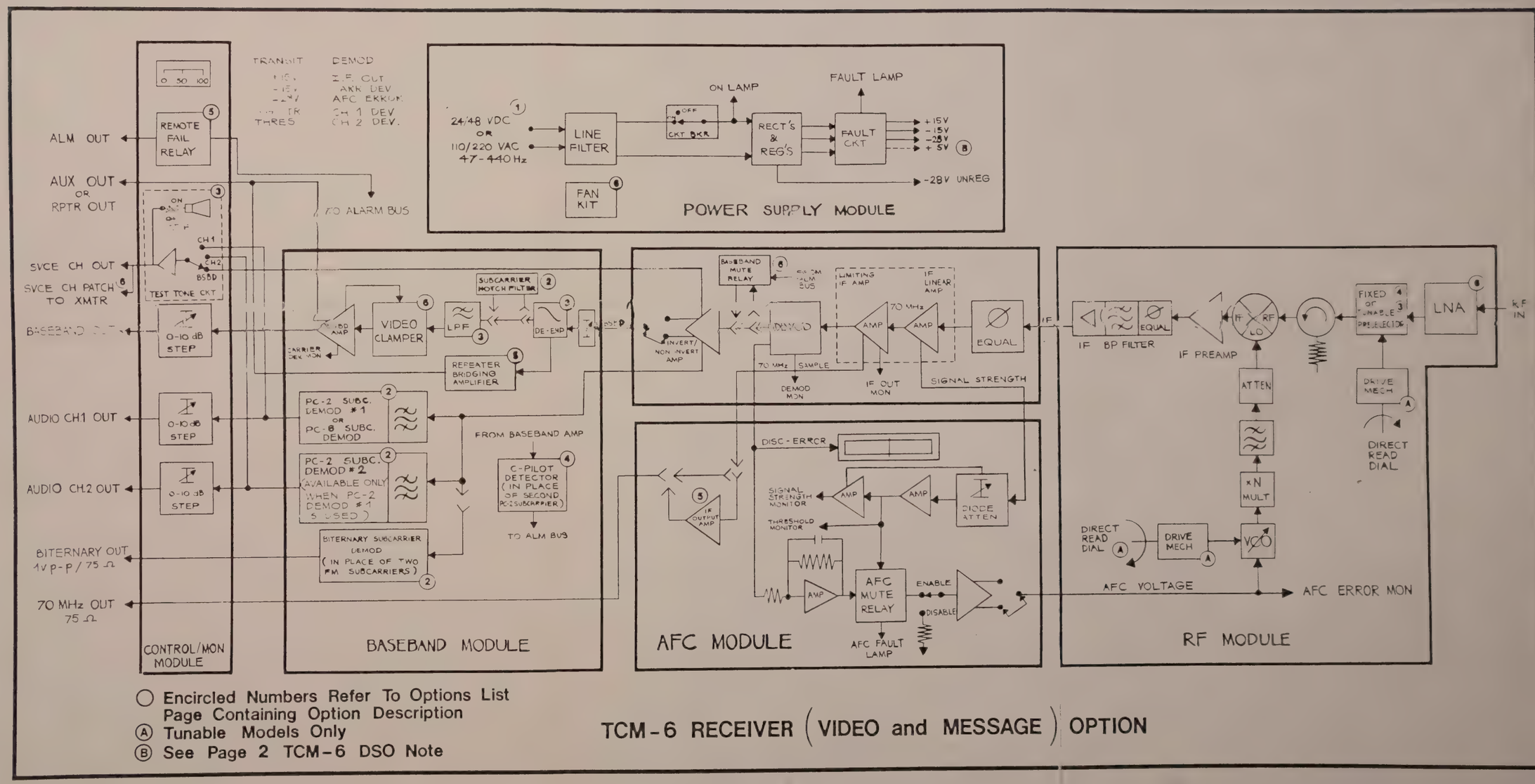
Ⓑ In The Case Of Coded Formats The Crystal Reference Clock Is On The Interface Converter

Ⓒ Used Only In Low Frequency Models

Ⓓ When An Interface Option Uses Balanced Timing A Subcarrier Channel Cannot Be Used

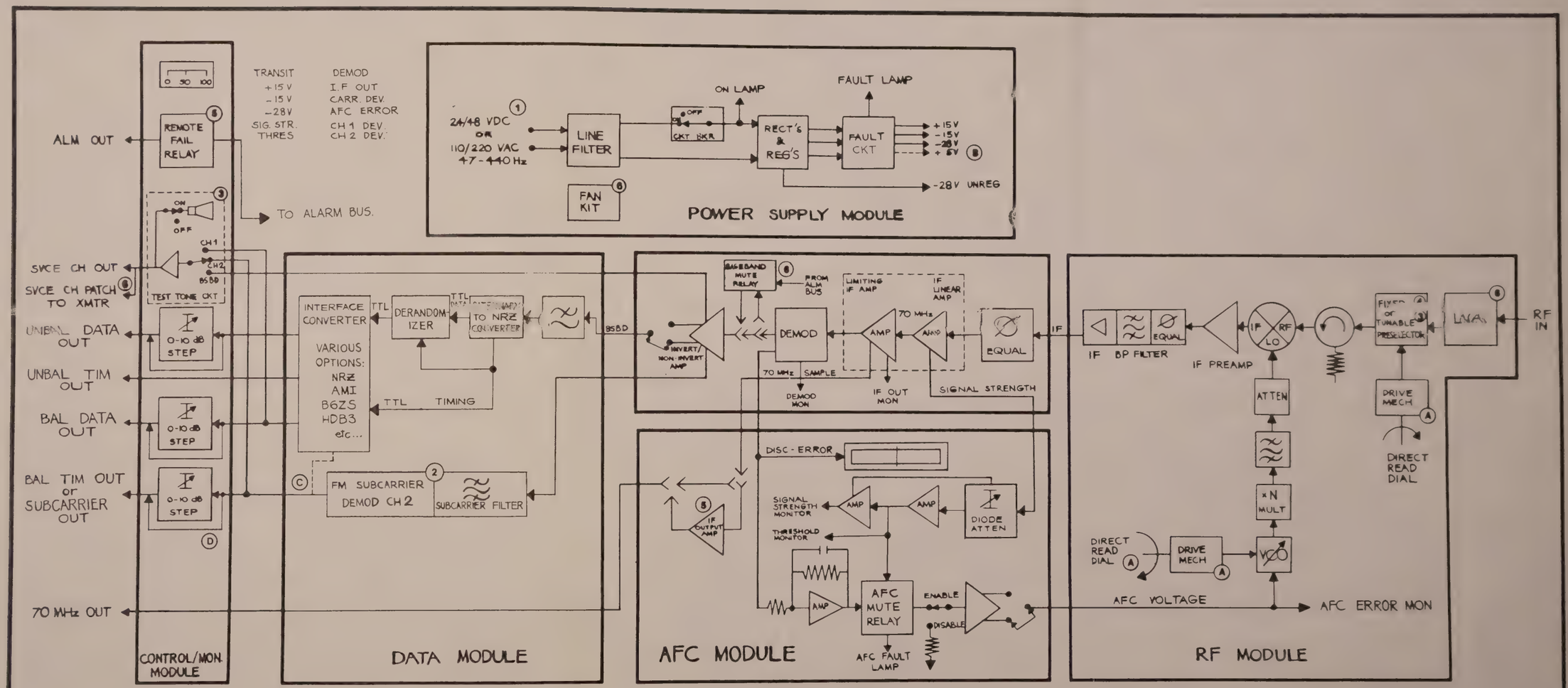
Ⓔ Attenuators Are Bypassed When Using Data

TCM-610 TRANSMITTER DATA OPTIONS



○ Encircled Numbers Refer To Options List Page Containing Option Description
Ⓐ Tunable Models Only
Ⓑ See Page 2 TCM-6 DSO Note

TCM-6 RECEIVER (VIDEO and MESSAGE) OPTION



○ Encircled Numbers Refer To Options List Page Containing Option Description
Ⓐ Tunable Models Only
Ⓑ See Page 2 TCM-6 DSO Note
Ⓒ When An Interface Option Uses Balanced Timing A Subcarrier Channel Cannot Be Used
Ⓓ Attenuators Are Bypassed When Using Data

TCM-6 RECEIVER-DATA OPTION

+15 red
-15 green
-28 blue
+5 orange
gnd black

blue W - control
red W - signal
black W - gnd

REVISIONS

EFFECTIVITY	ZONE/LTR	DESCRIPTION	DATE	APPROVED
	B	REDRAWN (ON 1525) KR 4-3-78		

REAR CONNECTOR A8 PANEL

AC CONTROL/MON MODULE (1201622)

FAIL RELAY W
FAIL RELAY NO
FAIL RELAY
V.O. DE-ENER
N.C. ENER
FAIL ALM BUSS
A7-TB1-B7
A7-TB1-B8

70 MHz OUT
FROM A3 P3 -A3

MESSAGE/VIDEO OUT
1.0V P-P TT (720 KHz) (TYP)
B BAND ATTEN

SVCE CH OUT
SVCE CH (PATCH TO RECEIVER)
-28V
TO A7 TB1-4B
SPKR
ON OFF
SPKR DR AMPL (2011103)

AUD CH1 OUTPUT
AUD CH1 ATTEN

AUD CH2 OUTPUT
AUD CH2 ATTEN

MONITOR METER
TRANSIT
SW POS

REMOTE MON OUT (17 OF 19 PINS)
FROM A7J6

AUX OUT
FROM P1 -A1

MON INPUTS

+15VDC	2	-6 A7-TB1-18
-15VDC	3	-7 A7-TB1-38
-28VDC	4	-8 A7-TB1-48
SIG STR	5	-9 A3-P3-1
THRES	6	-11 A3-P3-2
DEMOD	7	-12 A4-P4-1
IF OUT	8	-13 A4-P4-2
CARR DEV	9	-14 A1-P1-1
AFC ERR	10	-15 A2-P2-1
CH1 DEV	11	-16 A1-P1-2
CH2 DEV	12	-17 A1-P1-3

A1 BASE BAND MODULE (1201657)

AUX OUT
AB-J14
+15VDC
-15VDC
-28VDC
GND
TO A6-P1-13
TO A6-P1-12
A7-TB1-B
VIDEO RESPONCE
0.6V P-P/5MHz P.P. (.25 mW/200 KHz RMS)
B BAND AMP (2011572)
VIDEO CLAMPER
LOW PASS FILTER (2011573)
DE-EMPHASIS (2010025 MOD) (2010026 TV)
VIDEO RESPONSE
VIDEO RESPONSE
TO A6-P1
BSBD OUT
A4J4-12
CHAR DEV MOD
A6-P1-14
A6-P1-16
A6-P1-17
LH1 DEV
CH1
CH2 DEV
AUD CH1 SUBCARR DEMOD (2011057)
AUD CH2 SUBCARR DEMOD (2011057)
SUBCARR BPF (2011040) ± 300 KHz
FAIL ALM BUSS
A7-TB1-B8
NOTE A

A4 I.F. DEMOD MODULE (1201655)

IF OUT MON
TO A6-P1-13
DEMOD MON
TO A6-P1-12
A7-TB1-B
+15VDC
-15VDC
-28VDC
GND
400 MV RF MEASURED ON CASE OF FIRST XISTER
~25 MV/MHz SETABLE
70 MHz IN
EQUAL DELAY
MAIN IF AMP (1201003)
-3 TO -1.5V
DISC ERR OUT
-24 dBM
70 MHz SAMPLE
SIG STR OUT
NOTE A

A2 RF MODULE (1201652)

-30 dBM
I.F. B.P.F. (1201012)
EQUAL
-54 dBM
IF PRE-AMP (1201008)
-37 dBM
70 MHz IF OUT
1K ± 30 MHz 10 MW ± 5 MW
R.F. B.P.F.
NOTE A
J16
-30 dBM
+15VDC
-28VDC
GND
DIRECT READ DIAL
I.F. MON
-7V AFC (DISABLE) SWING ±4V
VCO
DRIVE MECH
ATTEN
XN
DRIVE MECH
DIRECT READ DIAL
N DEPENDS ON RF UNIT FREQUENCY
NOTE A

A3 AFC MODULE (1201656)

A8-J8
P3
A-3
70 MHz OUT 2 dBM
HIGH LEVEL 70 MHz AMP (1201519)
SIG STR MON
THRES MON
RCVR SIG STR (1201009)
SIG STR IN
AFC DIFF AMP + CONT. 1201014, P2
ENABLE
DISABLE
MUTE
AFC FAULT
AFC OUT
DIFF AMP
REF
DIS ERR IN
AFC METER
+15VDC
-15VDC
-28VDC
GND
A7-TB1-B
FAIL ALM BUSS
NOTE A

A5 POWER SUPPLY MODULE (1201586)

PWR SPLY FAULT
PWR SPLY ON
ON
OFF
CKT BRKR
XFRMR RECT'S REG
+15VDC
-15VDC
-28VDC
GND
UNREG -28VDC
.5 AMP
TO CONTROL MON UNIT
110/220 VAC 47 TO 440 Hz
HIGH
GND
LOW
LINE FILTER
+24, -24, +48 OR -48 VDC
NOTE A

A7 WEB HARNESS ASSEMBLY
TO RCVR UNITS
+15VDC
-15VDC
-28VDC
GND
7-28 UNREG
FAIL ALM BUS

A RF TO IF CONVERSION GAIN: 27db. 1db COMPRESSION AT ~0 dBM OUT. USEABLE R.F. INPUT -30 dBM TO -80 dBM.

A * INDICATES OPTIONAL CIRCUITS. INTERPRET DRAWING IN ACCORDANCE WITH NOTE: UNLESS OTHERWISE SPECIFIED

A USABLE AFC INPUT: ± 250 MV. AFC OUTPUT: -7.000 ± 4 V. SIG STR INPUT: 0 dBM TO -50 dBM. THRES. MUTE: -55 dBM INPUT.

A USABLE INPUT: 0 dBM TO -50 dBM 75 MV/MHz OUT

A A7 IS COMPLETE RECEIVER WIRING HARNESS.

A DC INPUT LEADS NOT USED IN AC POWER SUPPLY OPTION.

A RF B.P.F. MAY BE A MECHANICALLY TUNED PRESELECTOR.

A DE-EMPHASIS CORNER WILL CHANGE WITH LINE DESIGNATION. LOW PASS FILTER CAN BE AT ANY FREQUENCY UP TO 20 MHz.

LIST OF MATERIAL

ITEM NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT	PART OR IDENTIFYING NO.	MATERIAL — SPECIFICATION	NOTE NO.	ZONE	REQD PER ASSY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
LINEAR XX ± .03 XXX ± .010
ANGULAR ± 0° 30'
HOLES PER AND10387
ALL MACHINED SURFACES
FINISH
CONTRACT NUMBER
DESIGN ACTIVITY APPROVAL
DESIGN APPROVAL

TERRACOM DIVISION CONC CORPORATION SAN DIEGO, CALIFORNIA A LORAL SUBSIDIARY

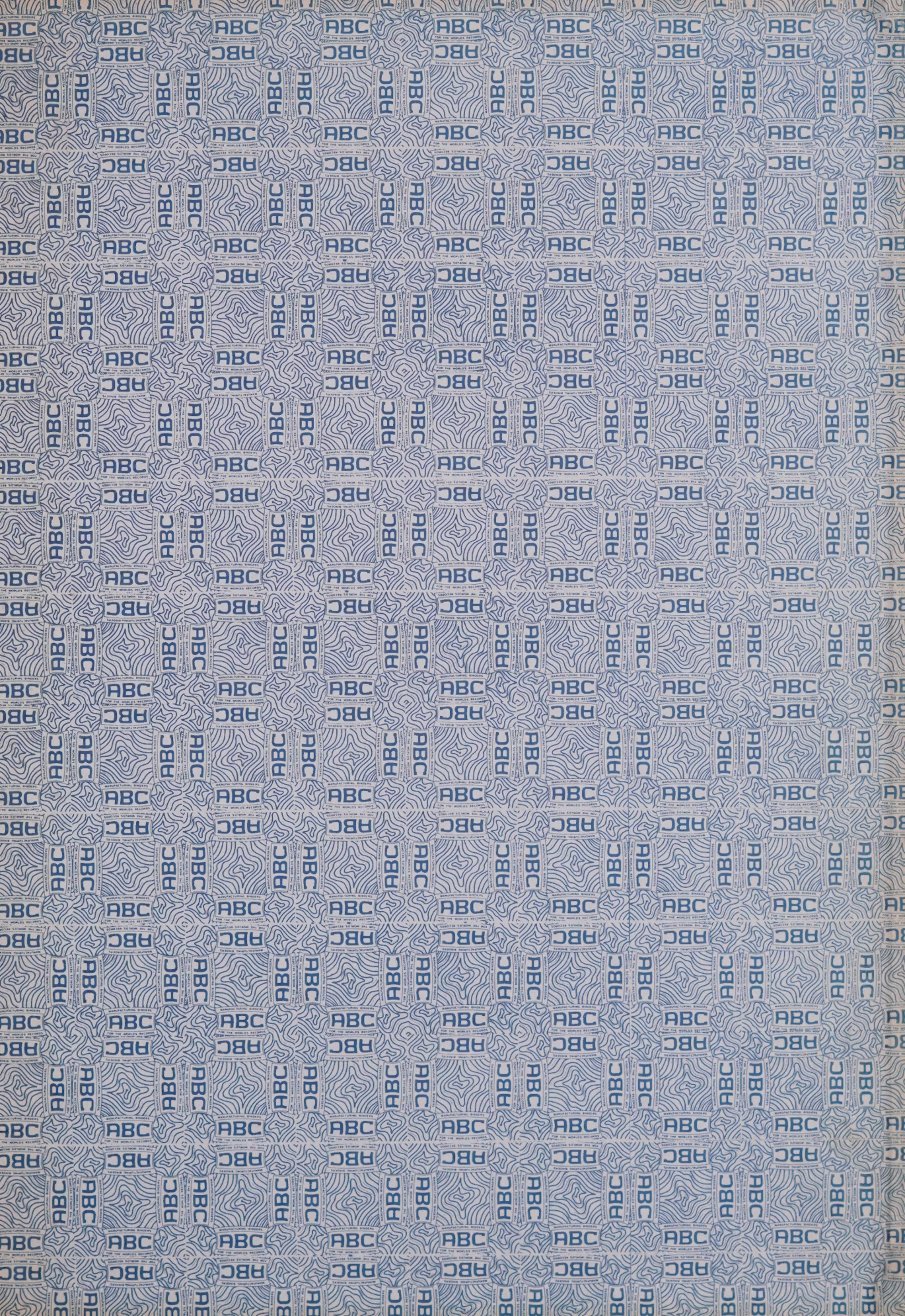
BLOCK DIAGRAM TCM-6 RECEIVER

SIZE E | CODE IDENT NO. 15895 | DRAWING NUMBER 12010275 | LTR B

SCALE NONE | SHEET 1 OF 1

QTY REQD	USED ON	NEXT ASSY

12010275 B


ABC